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Forthcoming Events.

NOVEMBER 16.

Sheffield Society of Engineers and Metallurgists: Ordinary meeting at Sheffield. "Metallurgical Examination of the Cutting Edges of Razor Blades, Knives, and Metal Cutting Tools." Paper by J. F. Kayser.

Faraday Society: Ordinary meeting in London.

NOVEMBER 19-26.

Public Works, Roads and Transport Congress and Exhibition at the Royal Agricultural Hall, London.

NOVEMBER 18.

British Cast Iron Research Association:—Annual general meeting in London.

NOVEMBER 23-DECEMBER 5.

Shipping, Engineering, and Machinery Exhibition at Olympia.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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The Detroit Congress.

The successful convention of the American Foundrymen's Association, which has recently been held at Syracuse, was attended by Mr. V. Delport, a delegate of the Foreign Relationship Sub-Committee of the Institute of British Foundrymen. Mr. Delport has now returned to England, and informs us that a skeleton programme for next year's International Foundrymen's Congress has been built up. The venue is to be Detroit City, and the period is to extend from September 27 to October 1. It is expected that Mr. Stuart W. Uttley, who is Vice-President and general manager of the Detroit Steel Castings Company, will preside. Early this week the various branches of the Institute of British Foundrymen received a formal but exceedingly cordial invitation to take part. Whilst other international foundry conventions have been held, the Detroit meeting will be the first truly international one, as it is expected that, in addition to the British, French, Belgian, Italian, and Spanish delegates, there will be representatives from Germany, Czecho-Slovakia, and most other European countries. It is not anticipated that the participation of ex-enemy delegates will cause any difficulties, as some of the principal leaders of French and German foundry thought have already appeared on the same platform at the recent Czecko-Slovakian foundry congress.

The week preceding the Congress, and the ten days following, will be devoted to touring the North-Eastern district of America, most of that time being devoted to visiting foundries of various types, and obviously some sight-seeing will be included. There are foundries in the neighbourhood of Pittsburgh, Philadelphia, Buffalo, Cleveland, and Detroit, and visitors will have the choice of inspecting those plants in which they are most interested. Those visiting the country for the first time will no doubt want to see something of the country, and opportunities will be given for seeing New York, Niagara, and probably Washington.

The Exhibition, which will take place in connection with the Congress, will be of outstanding interest for the visitors. At Syracuse last month there were about 200 exhibits, and it attracted no less than 4,000 delegates.

Material details will be handled by a leading travel agency, and the delegation will be accompanied on the other side by a courier. Those who wish to travel with the group will find it more economical, and will be freed from petty worries. However, if preferred, visitors can make their own travelling arrangement.

The total duration of the trip will be about six weeks, starting probably on September 11 and landing back on October 21. Those who are pressed for time may start a week later and return immediately after the Congress.

The choice of Detroit is a happy one, owing to its proximity to the Canadian border, which should ensure a strong contingent of foundrymen from that country. The city is also the centre of automobile industry in America, and if America excels in anything it is in the quantity production of motor cars.

Foundry executives who propose taking business trips to the United States in the near future would do well to consider whether they cannot postpone their visit until next autumn, as the facilities offered by the above programme are extremely promising, and are not such as can be lightly dismissed.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Pearlitic Cast Iron.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Referring to my letter on Pearlitic cast iron published in the last issue of THE JOURNAL, two errors have crept into my typescript.

On page 380, column 2, when dealing with the analysis of Pearlitic iron, I omitted to give silicon content, which was 1.05 per cent. The cheap brand of Midland No. 4 pig-iron referred to in the second column, page 398, should read "2.35 per cent. silicon," and not "2.85 per cent." Additionally there is a typographical error on page 398, column 1, where "breach ends of combustion chambers" should read "breach ends or combustion chambers."—Yours, etc.,

E. LONGDEN.

Carlbourne Villas,
Main Street,
Menston, near Leeds.
November 7, 1925.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Mr. Smeeton's reply to my letter in your Journal is most disappointing, and I note that my questions can only be dealt with at meetings of Technical Societies. Unfortunately, at meetings, political, social, or technical, as soon as any discussion is started the chairman suddenly discovers that it is "time, gentlemen, please," the usual vote of thanks is passed, and that is my reason for thinking that the matter could be ventilated more satisfactorily in your paper.

I am pleased to see that Mr. Longden agrees with some of my statements, and I note that he has the same ideas as I have about the practicability of heating large moulds effectively.

In my own experience, some years ago, great difficulty was experienced in getting what is now called pearlitic iron to run the thin sections of a very intricate casting. The metal appeared to be sluggish, and to set very quickly. The mould was, therefore, heated to as high a temperature as possible to see if that would help the trouble, unfortunately, it only started another, namely, gassy holes. This was reasoned out as being owing to the mould being at a high temperature, the sand had become less permeable and the gases could not entirely escape.

I never had the experience of the test bars of pearlitic iron cast in a cold mould turning out to be white iron, as Mr. Longden states, but this is possibly due to different irons being used.

Regarding the use of pearlitic iron for combustion chamber covers, pistons, etc., it does not appear to matter what kind of special iron is put in, there seems to be trouble. I see that a large Continental Diesel engine builder is now fitting cast steel covers, and probably aluminium alloy pistons will soon be used.

It would be very interesting to have other ironfounders' views and experiences of pearlitic iron, as it is only in this manner that we shall be able to advance the science of ironfounding.

Meantime, I only wish to get further information, and I think the way to this is through your valuable paper, and not by means of scientific essays at technical meetings where the practical is ignored. Yours, etc.,

"A FOUNDRY DIRECTOR."

St. Dunstan's.

The tenth annual report of the work carried out at St. Dunstan's contains an interesting souvenir supplement devoted to a report of the speeches made at the Anniversary Dinner. It is pleasing to note that the excellent work of St. Dunstan's is being extended to cater for those who are now going blind as a result of war injuries. This involves additional expenditure, and public generosity is being relied upon to provide additional funds.

Important Foundry Equipment and Supply Development.

It is officially announced that the old-established business of Thwaites Bros., Limited, Bradford, is to be finally closed down shortly, and that the whole of the goodwill, patterns, drawings, etc., have been acquired by New Alldays & Onions, Limited, of Small Heath.

Thwaites Bros. have been actively engaged for many years on the production of blowers, cupolas, etc. There will be no stoppage of work so far as the productions of Thwaites Bros. are concerned, as all arrangements are being carried out to ensure the continuity of the business at Birmingham.

New Alldays & Onions, Limited, comprises the business of Alldays & Onions, Limited, which was founded in 1650, the edge runner and sand mill business lately carried on by E. T. Neal & Company, Kettering, the Eades Hoist Company, Limited, manufacturers of lifting tackle, Alldays Motor Repairs, Limited, and other businesses.

The engineering plant at the Vulcan Ironworks was sold by auction on November 10, 11 and 12. The business of Thwaites Bros., Limited, was extended considerably during the war, and buildings and furnaces were erected for the manufacture of munitions, and a large amount of labour was employed.

Mons. Ronceray to Lecture in Birmingham.

M. Ronceray, of Paris, will lecture on the "French Foundry Technical High School," at the Engineers' Club, Birmingham, on Thursday, November 26, at 7.30 p.m. The Engineers' Club has the premises of the Midland Conservative Club, Waterloo Street, and those who signify their intention of being present to the Secretary of the British Cast Iron Research Association, New Street, or to Mr. H. J. Roe, Local Secretary of the Institute of British Foundrymen, 33, Herbert Road, Bearwood, will receive a card making them honorary members of the Club for the evening and entitling them to use the facilities of the Club in full. No card, however, is required for admission to the lecture, which will be followed by a discussion. This High School is the most interesting development in foundry education in Europe, and a large share of the credit of its foundation is due to M. Ronceray.

B.C.I.R.A. Annual Meeting.

The annual general meeting of the British Cast Iron Research Association will take place at the Midland Grand Hotel, St. Pancras, London, on Wednesday, November 18, at 12.15 p.m. The annual meeting will be followed by luncheon at 1 p.m., at which the President, Sir John Dewrance, K.B.E., will preside. Amongst others who will be present are Sir William Ellis, G.B.E., Eng. Vice-Admiral Sir Robert Dixon, K.C.B., Mr. A. L. Hetherington, from the Department of Scientific and Industrial Research, Sir William Jones, K.B.E., Dr. W. Rosenhain, F.R.S., Professor P. G. H. Boswell, D.Sc., Professor H. C. H. Carpenter, F.R.S., Sir Robert Hadfield, F.R.S., and Mr. C. E. Lloyd, M.P. Any member of the Association who has by any chance not received an invitation should communicate immediately with the Secretary, 75, New Street, Birmingham.

Sheffield Metallurgist's Italian Appointment.

Mr. L. T. Swift, who has long been engaged in the metallurgical research department of Messrs Hadfields, Limited, of Hecla Works, Sheffield, is shortly leaving this country to take up an appointment with the important concerns of Terni and Magona, in Italy.

Moulding Machines.

By E. Longden, M.I.Brit.F.

(*Continued from page* 372.)

Centrifugal Casting.

In pipe moulding there are various devices and modifications of moulding machines. Of course, the most modern pipe moulding or casting machine is the centrifugal casting process as practised by the Stanton Ironworks Company, Limited. The Centrifugal Castings Company, Limited, Scotland, also make some wonderful castings centrifugally.

In the hollow-ware foundries very few power-moulding machines are used, nor in the textile, stove grate or radiator foundries. In radiator foundries, it is thought, machines are employed for making the cores. During the Glasgow Conference period a visit was paid to a well-known

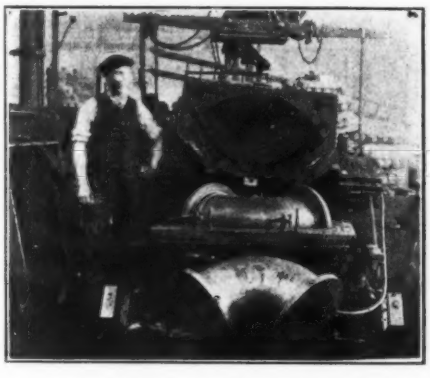


Fig. 9.—Making a 12-in. Elbow Core.

company's works. They produced in their foundries large quantities of stove grate, rain water and general builders' castings. The writer does not remember seeing more than about six power-moulding machines in the whole of their extensive foundries, two being sand slingers, the remainder being large jolt ram machines of German origin. This was very startling, because the foundries were very large and all castings of a purely repetition nature. Castings were actually being made from loose patterns with considerable numbers off. They must be able to produce cheaply, otherwise

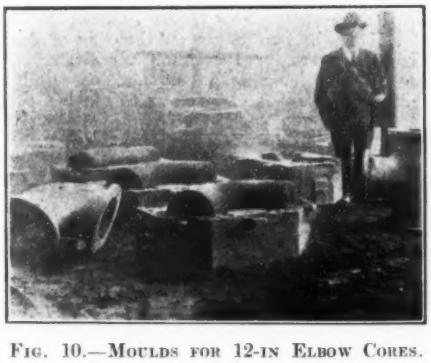


Fig. 10.—Moulds for 12-in Elbow Cores.

the question of moulding machines would have been forced on them. The founder must decide which type of machine will suit the particular line of castings to be made.

The withdrawal of the pattern will depend on the depth of pattern above the pattern plate. With fairly shallow patterns and plenty of taper the boxes are either lifted off by hand or the plate lowered away from mould. In this case there is always the danger of breaking the edges of the mould and the sand falling away, and the box must be turned over.

A better method is to turn the pattern over in contact with the sand and box and then either lift the pattern from the mould or lower the mould from pattern. Any loosened sand can then be easily pressed back into position. Such methods are very advisable with deep moulds.

Stripping Plates.

Turnover plates alone may not be suitable for deep, straight-sided or intricate moulds; in such cases various types of stripping plates are employed to support and lift the sand from around the pattern. A simple stripping plate is sometimes devised so that when the moulding box is turned over and the plate withdrawn the strip plate falls with the box, carrying the sand with it right close to the pattern. In other cases a pattern is drawn through the stripper, and so on.

Stripping plates are very often expensive. Instead of copying exactly the shape of outline of

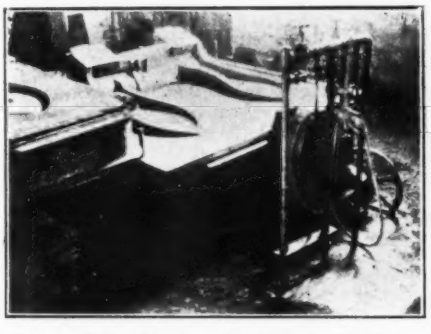


Fig. 11.—Making an Anchor Mould.

the pattern the plate is sometimes made with an opening somewhat larger than the pattern around which it is placed and a fusible metal poured into the space thus formed. Some wonderful and ingenious combinations of stripping plates are employed in the motor-car trade.

Core-making machinery follows on very much the same lines as moulding machines. Also there are machines on which can be made both round and square cores after the fashion of the sausages. The same type of cores can be made in tubes in short lengths rammed by hand, and are then ejected from the core box mechanically.

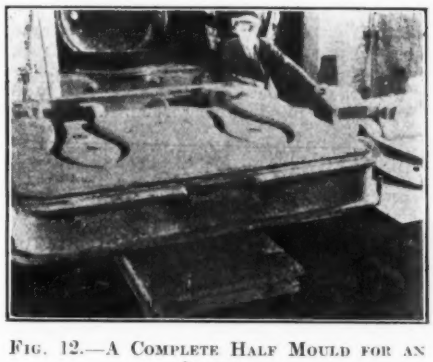


Fig. 12.—A Complete Half Mould for an Anchor.

Jolt Machines.

The plain jar-ram machine eliminates hand ramming, the making of joints, and in many cases the cutting of runner gates, etc. Even with a plain jolt the time saved can be very considerable, as the time to ram sand moulds can exceed 50 per cent. of the total time to make the complete mould. Large moulds can be rammed in about 30 seconds.

A jarring turnover and pattern drawing machine goes much further and cuts out the labour of turning the box over by hand or crane and the drawing of the pattern, which is done more steadily than by hand, with the consequent saving in repairs.

Jar and stripping machines take a shorter cut to the complete mould. After jarring, the sand and box is stripped upwards from the pattern or the pattern is drawn downwards through the strip plate, whilst the jar squeeze and stripping machine cuts out also the flat ramming of the top of the sand after jolting.

The plain squeezer machine cuts out most of the

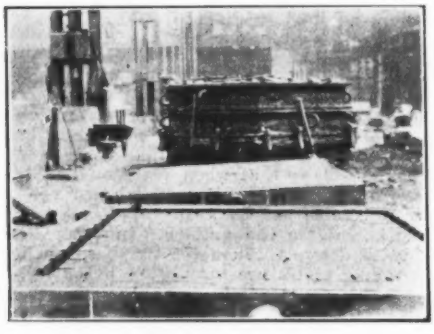


FIG. 13.—MAKING A TANK PLATE.

hand ramming only, always remembering that there is the saving in all types of machines of the making of joints and cutting of gits, and, again, the more perfect pattern draw and lifts which reduces mould repair, as previously stated.

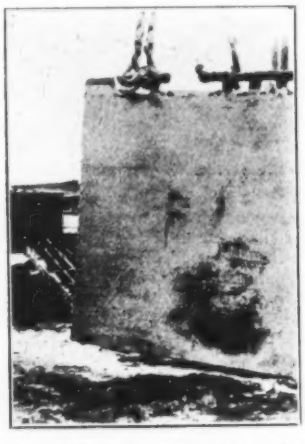


FIG. 14.—THE FINISHED TANK PLATE.

There is an air-operated squeezer machine which is described as the sand straddler. It is mounted on wheels, the body having a wide span to enable the machine to pass over or straddle the sand heap which is piled in long rows. As the moulds

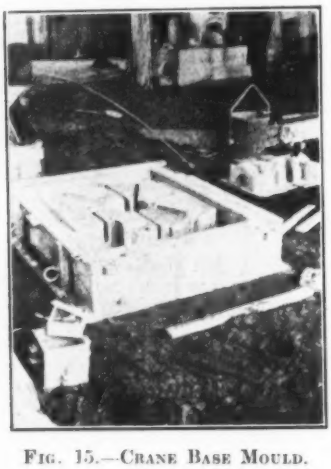


FIG. 15.—CRANE BASE MOULD.

are made the machine is pushed forward, thereby avoiding the labour of carrying the completed moulds any distance.

It seems hardly necessary to explain what happens when sand is jolted in a container like a moulding box. Each jolt of the machine can be equal to hundreds or even thousands of blows by

FIG. 16.—ANNEALING PAN MAKING. FILLING IN THE MOULD.

the ordinary hand rammer. Frames are usually placed above the flask to provide sufficient sand completely to fill the flask when ramming is com-

FIG. 17.—ANNEALING PAN MAKING. RAISING THE MOULD.

plete. It is better to err on the side of feeding in too much sand rather than too little. Sometimes when jolting large moulds, especially the bottom part, sand is first fed in to reach a certain

FIG. 18.—ANNEALING PAN MAKING. LOWERING THE MOULD.

part of the pattern after jolting, incidentally allowing the moulder to tuck vital places; then sufficient sand is again piled in the box com-

pletely to fill the box after jolting. Only in very rare cases is it necessary to ram the mould in more than three stages. The moulder should help the sink of the sand by spreading the sand out-

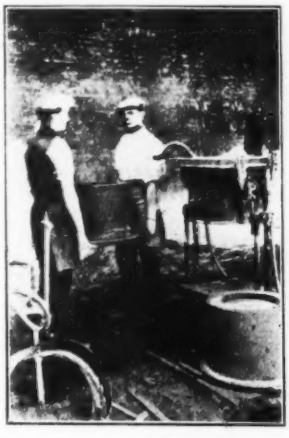


Fig. 19.—Annealing Pan Making. Removing the Mould.

wards from the middle as jolting proceeds. If the contour of the pattern is such that there are no projections the ramming is ideal. But, as will be imagined, the sand during jolting will sink away under projections. To overcome this weak-

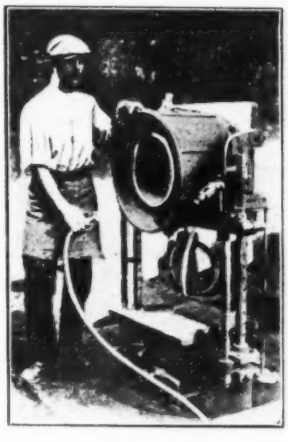


Fig. 20.—Annealing Pan Making. Machine Table Tilted.

ness in the ramming process various devices are adopted. In many cases a simple blocking and coring out under the projection is all that is needed. In other cases blocks of wood are placed

Fig. 21.—Annealing Pan Making. Pouring the Moulds.

above these projections, and after jolting taken away to allow the soft places to be hand rammed. In certain cases a hole suitably shuttered can be arranged for in the side of the moulding box, so that after jolting difficult and undercut portions of the mould can be rammed by hand. Oil sand cores can be made to form certain parts of a mould and inserted in the moulding box before filling in the sand and jolting. Oil sand cores can also be located in the mould during the ramming up stage

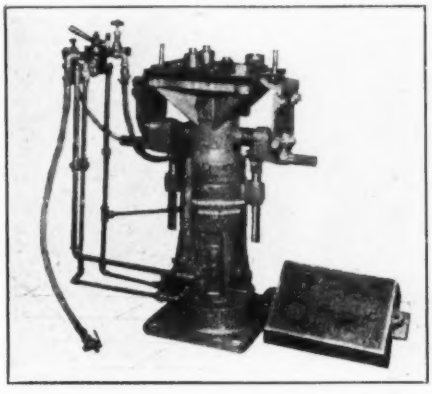


Fig. 22.—No. 1 Ajax Pattern Drawing Machine.

to form sturdy seatings or prints for receiving and holding heavy cores. Properly made oil sand cores will stand the jolting very well indeed. There are many other devices, but the above outline will set the candidate for jolt ramming thinking along the right lines.

Care must be exercised when preparing facing sand for jolt ram machines. The sand must posssess sufficient plasticity at the mould joint to retain a perfect outline of the pattern; above the joint and over the remainder of the pattern it can be a little more open. The backing up sand is not so important, but it should have the property of cohesiveness. One advantage in favour

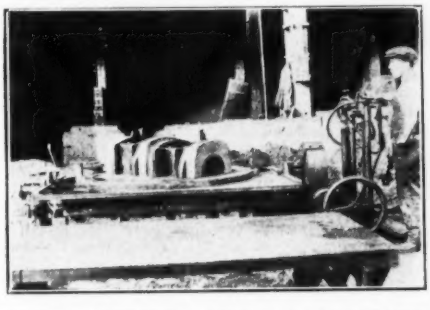


Fig. 23.—Moulding Australian Axle Boxes. The Pattern Mounted.

of the jolt ram machine is concerned with the facing sand. When once the pattern is covered with facing and the backing sand filled in, the jolting action never disturbs the facing material, therefore there is no possibility of the rough black backing sand getting in contact with the pattern.

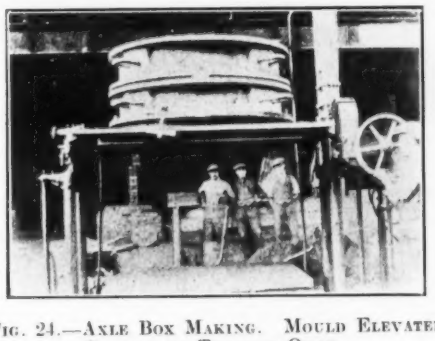


Fig. 24.—Axle Box Making. Mould Elevated Ready for Turning Over.

As facing sand entails considerable cost to bring it to the right condition, it can be used sparingly without fear of any part of the pattern becoming exposed to the rougher backing sand.

Hydraulic Moulding Machines.

The systems as practised by the Bonvillain and Ronceray Company for use on their hydraulic moulding machines seem to be developments of the early work of such men as Jobson and certain German and French inventors. It is thought they have either three or four patented systems.

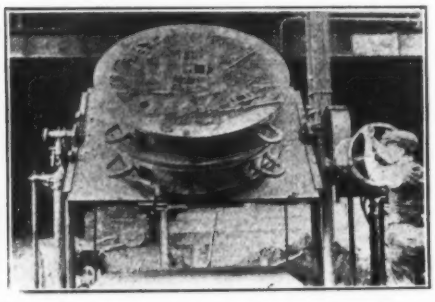


FIG. 25.—MAKING AXLE BOXES. THE MOULD BEING TURNED OVER.

They teach the purchaser how to make match and pattern plates almost entirely by the moulder.

The system, termed "The Reversing Pattern Plate," used to be arranged something like the following: The ordinary wooden pattern is made to make a sand mould in the usual way, using a machined and correctly fitting two-part box with special pinning arrangement. After the top part has been taken off the two half boxes are placed

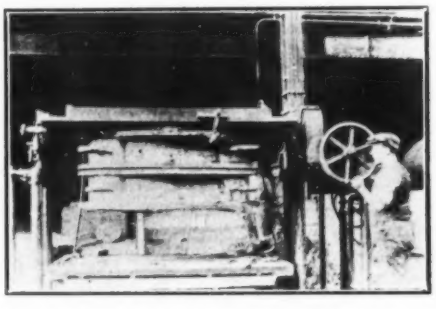


FIG. 26.—MAKING AXLE BOXES. THE MOULD COMPLETELY INVERTED.

together, joints upwards, the machined sides of the boxes securing exact alignment relative to the pattern or patterns in the moulding box. The two parts are bolted together, a frame is placed on the two boxes and filled with plaster-of-paris, the resulting plaster pattern plate holding both halves of the pattern. Two sand impressions taken from such a plate and placed together will make a mould containing two castings, thus allowing pro-

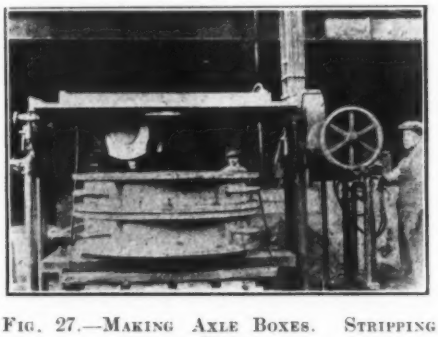


FIG. 27.—MAKING AXLE BOXES. STRIPPING THE PATTERN.

duction on one machine. It pays to adopt this method for numbers of 100 off each piece.

For numbers of more than 100 it pays to make a more substantial pattern, so that a gypsum plate is made faced with a thin layer of white metal. To make such a plate a complete mould is made in the usual way, well smoothed and blackened to give a high polish. Sand moulds are then made from this sand mould, giving a reproduction of the pattern in sand. The face of the sand pattern is then carved all over to a depth of about $\frac{1}{8}$ in. to $\frac{1}{4}$ in. When the two sets of half boxes are placed together a hollow space is formed, into which a white metal is poured, thus giving a layer of about $\frac{1}{8}$ to $\frac{1}{4}$ in. of metal. The hollow metal pattern is placed in an iron frame and backed with Gypsum. Patterns are quickly and easily made.

If the reversing pattern plate is considered cumbersome, two plates can be made, one having

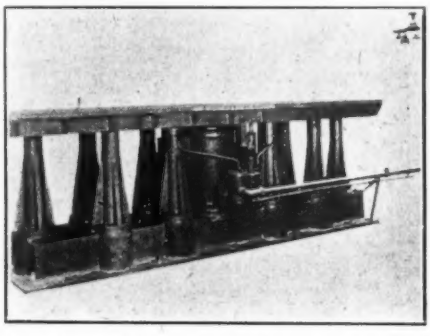


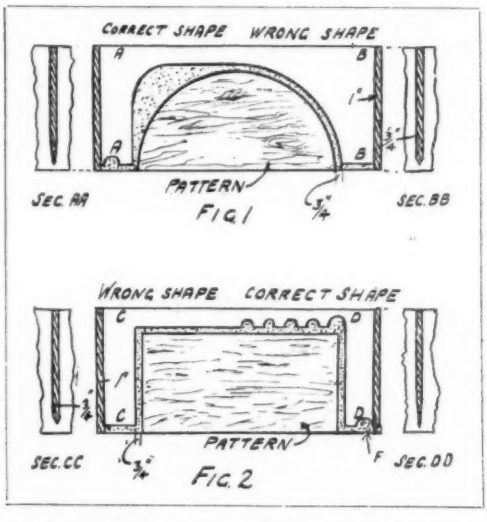
FIG. 28.—A No. 20 AJAX MACHINE FOR LAMP POSTS, ETC.

the top impression and the other the bottom impression. In such a case it is usual to work on two machines.

Many modifications of the above methods have been general in most districts for many years.

Built-up Pattern Plates.

The built-up pattern plate is a term which can be explained in two ways. One could describe a machined plate on which is built one or more patterns with runner gates as a built-up pattern plate, but the term is applied mostly to describe a plate made up of a number of small plates held together in a common frame. One or more of the



plates can be taken out of the frame and replaced by others as desired. The small plates are about $\frac{1}{2}$" in. thick and made in the same manner as the reversing plates as explained earlier. The following pictures and remarks will illustrate the making of various substantial castings on the "Ajax" jarring machines.

Figs. 9 and 10 show the patterns and moulds of a 12-in. elbow pipe. Some of the moulds are cored. The half pattern is seen on the turnover table of the machine, a half-mould on the crane chains and a complete casting fronts the machine. The production is 12 castings per day.

Fig. 11 gives a picture of the moulding of a large anchor, the half pattern of which is secured to the turnover table of a No. 20 "Ajax" Jarring Turnover Machine. Fig. 12 shows a complete half mould resting on the mould carriage. The size of the moulding box is 6 ft. 9 in. × 6 ft. 9 in. × 19 in.

deep on the one side and tapering down to 12 in. on the other. The output was three steel anchor castings per day.

Figs. 13 and 14 show a 5 ft. sq. tank plate made on a No. 20 "Ajax" plain jar machine. Fig. 13 depicts the bottom and top moulds. The top mould is proof that flat tops can be jar rammed with complete success. The boxes are 6 ft. 2 in. × 5 ft. 7 in. × 7 in. deep. The important point to consider when jar ramming flat top parts is to have the bars the correct distance from the face of the plate and the bevel edge of the bars at the correct angle. Fig. 14 shows the flange side of the casting.

Fig. 15 describes a large mould for a crane base, the size of box is 9 ft. × 7 ft. 10 in. × 22 in. for

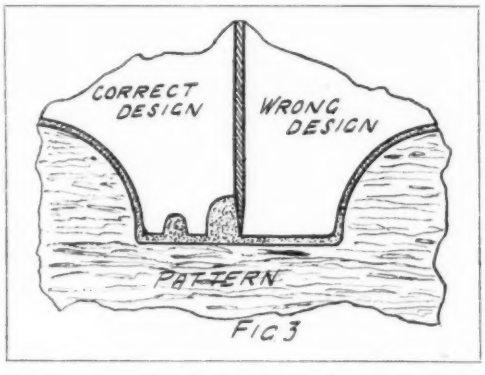


FIG 3

the drag and the depth of the core box is 14 in. The machine used for these moulds is a No. 24 turnover machine, the size of the turnover table being 10 ft. × 7 ft. Such a machine is in use in a large foundry in the North of England.

The pictures from Fig. 16 to Fig. 21 give the method of moulding annealing pan castings, these castings being extensively used by the malleable iron founders in the process of annealing castings. Fig. 16 shows the operator filling in the sand. The box is a permanent fixture on the machine table along with the pattern. The moulds are practically boxless in a sense, the complete mould being contained inside a perforated sheet steel slip case without lugs or pins. Fig. 17 depicts the mould elevated, a cast iron bottom plate being temporarily clamped to the top. The handles of the bottom plate are bent to allow hand room for the two men who carry out and lower to the floor. The clamping device is a fixture to the permanent

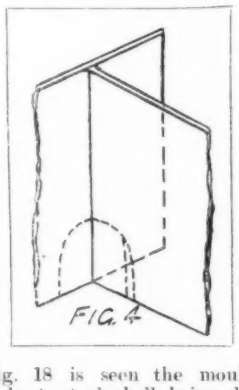
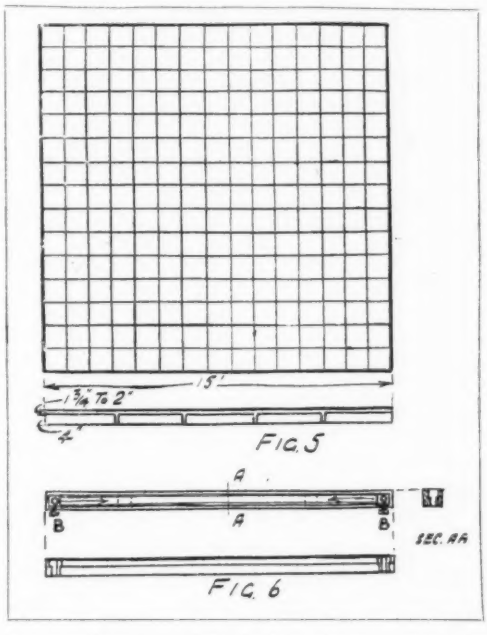


FIG. 4

box. In Fig. 18 is seen the mould contained within the sheet steel shell being lowered away from the pattern which is located within the permanent box. Note the perforations through the sheet steel shell; they provide for venting the mould. Again, in Fig. 19 is shown two men carrying away a completed mould. Another mould is seen on the floor close to the machine. These moulds leave their own core, and in this picture the green-sand core is visible and a portion of the five-spray gate on the joint at the left of the photograph. Note the permanent box in an inverted position on the machine table. Fig. 20 shows the machine table tilted and the operator blowing out any loose sand. The pattern is located in the centre of the permanent box. In Fig. 21 is shown a row of moulds covered and in the process of being poured. The top parts are very shallow and are rammed by hand, the box resting on a flat plate fixed to two supports at a standard working height for the operator. The machines used are the No. 6 "Ajax" jarring turnover, and the output is 100 12-in. pans per day from each machine. This plant is in operation near Birmingham.

A method of moulding the new British standard 12-ton axle box has been previously described.*

This method utilises two No. 6 jarring turnover machines working as one unit. The present actual output for the two machines is 50 complete axle



box castings, or 100 half castings. Fig. 22 describes the latest introduction of the "Ajax" jarring machine. This machine is a size No. 1, with pattern drawing device. It is an all-round air and oil controlled machine; the draw is oil controlled and the moulding box adjustments are air controlled, thus dispensing with the use of spanners and so saving time and energy. The machine accommodates about 10 different sizes of boxes.

The views from Figs. 23 to 27 illustrate the operations when moulding two large locomotive axle boxes of the Australian type. The first photograph shows the two patterns on the pattern plate and fixed to the machine table. Fig. 24 shows the turnover table and mould elevated and ready for

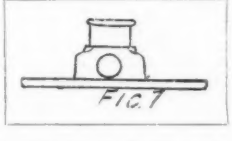


FIG. 7

turning over. Fig. 25 shows the mould being turned over, the picture Fig. 26 with the mould and table completely inverted and Fig. 27 the patterns drawn from the mould. The size of the moulding box is 5 in. to 6 in. dia. × 24 in. deep. Two parts bolted together form the complete box. The castings are steel and made in a large steel foundry in the North of England.

The next picture, Fig. 28, gives a view of a special plain jar machine for ramming long castings; it is size No. 20. Such castings as flanged pipes, lamp-posts, etc., are made on the machine. This type of machine is operated either by electric power or pneumatic.

Much of the improvement ascribed to moulding machines is due to the excellent provision of tackle. In many foundries, if tackle was made to suit the work made from loose patterns, improvement in quality and output would be noted, although falling far short of the output by modern moulding machines.

* FOUNDRY TRADE JOURNAL, January 31, 1924, page 88.

When making tackle for use on any type of machine the following sketches and hints are worth considering. They apply more particularly to the jolt ram machine.

Fig. 1 shows on the left side the correct way to shape a box bar; the right-hand side of the sketch describes the usual way in which bars are made, but it is the wrong way. By constructing the bars with a gradual taper, as seen in Sec. A, instead of like Sec. B, and the bar cut out instead of following the contour of the pattern, the sand during jolting will settle under the bars more easily, thus avoiding soft places. Fig. 2 gives a rectangular shape, and shows on the right-hand side the correct way to make the bar. By notching the bar in the way described the sand is better accommodated. Again, in Fig. 3 is shown on the left of the sketch the correct design of the bar, and on the right the wrong design, especially when it is desired to lift out cods of sand which have metal on the face of them. Fig. 4 shows by dotted lines the way such a bar should be made. Very often it is inconvenient to have snugs and trunnions on the same box. In certain cases the combination of trunnion with pin hole, as described in Fig. 7, is very useful.

In foundries making heavy castings much labour and time can be saved by making one or more cast-iron plates machined and lined in ft. sqs., as described in Fig. 5. In many instances, as when making large flywheels up to 15 tons, only one-half pattern need be made, which is correctly dowelled on the plate. Quite a variety of heavy castings can be made in this way. When one considers a large moulding box and the labour of lifting sand and other materials to a considerable height, the utility of the plate will become evident. By correctly dowelling on the plate each half mould can be rammed up separately at a convenient height from the floor. Fig. 6 is a sketch of a bar templet for drilling pin and dowel holes in such plates and boxes. The cups B can be adjusted for various sizes of boxes, etc.

Defective Castings.

By "VALLISHE."

There is little doubt that the subject of defective castings is one of the most difficult and complex problems in the whole foundry trade. In most foundries there is hardly a day passes without a certain number of defective castings. Perhaps a percentage, not above five, can to a certain extent be excused, but when 25 and even 30 per cent. of the cast is defective, the subject demands serious thought. At such times as these, with trade so inconsistent, defective castings must be brought down to a minimum. Besides loss incurred in wages, defective castings cause lower production coupled with higher production rates, loss in weight through constant re-melting, and other serious difficulties, besides often disappointing the customer through failure in complying with a promised delivery at a stated time. To shoulder all the blame on the moulder would be unfair, as the patternmaker is sometimes at fault, but in most cases the moulder is to blame.

Two Chief Causes of Defective Castings.

The two chief causes leading to the production of defective castings are as follows:—(1) Faults in the metal itself; (2) bad moulding and faulty pouring. The first cause includes such as sponginess, porosity, occluded gases and shots; the second cause includes bad features such as bad gating, bad venting, bad ramming, improper sand-mixing, faulty pouring, and too hot or too cold a metal.

The Prevention of such Defects.

In the case of machined castings, blowholes are perhaps the most common fault. These are of three distinct kinds, each resulting from totally different causes. They are as follows:—(1) Blowholes produced by occluded gases in the metal; (2) the presence of too large a quantity of unbalanced sulphur in the metal; (3) the placing of close-grained facing sand on the top or back of the patterns, thus preventing the air or gases from escaping out of the mould. It is interesting to note that the third is by far the most common cause of blowholes. Always use clean, open sand on the parts requiring machining, and be sure to vent well. It is often found that these defects mostly occur in top sections or back parts, and this shows us that air and gases are undoubtedly the main cause. A good plan is to use a very dry sand on machined parts. Good judgment, of course, must be exercised as to the ramming and drawing of the pattern, for if too dry a sand is used, the mould may suffer. Trowels and the water brush must not be used on these parts, as this often results in chilling the edges of the castings, and if occurring at a weak spot, the casting may crack. Runners should always be placed at a point where the metal may have an easy flow through the mould without causing friction on the faces of the mould. Risers, of course, should always be placed at the strongest part, especially when big risers are used. It is interesting to recall the casting of the cylinder for a large hydraulic press used in raising the Britannia Tubular Bridge, the press being made by the Bank Quay Foundry Company. To cast the cylinder 22 tons of fluid metal was required, the gate weighing over 2½ tons. The gate was kept in a fluid state for six hours after the run by replacing the metal after it became stiff with fresh metal from the furnace at the highest attainable temperature. This was for the purpose of supplying the space in this immense body of metal below, consequent upon the contraction. The metal was allowed a clear flow, the gate being stepped, and the resulting casting was a definite success. Special attention was paid to the gating, and it is partly due to this that such a satisfactory casting was obtained.

Attention should always be paid to the temperature of the molten metal Too hot a metal causes seams and scabs, and in the case of machined castings this is more important still. The gases should escape from the ladle when the metal has been poured into it from the cupola. Sometimes facing sand does not possess sufficient of sea coal, and this, coupled with too hot a metal, causes much trouble. Many a casting is rendered defective through an insufficient number of runners, thus causing a slow covering of the mould and resulting in seams and sometimes chills, or even shot iron. Too soft an iron is another common cause leading to defective castings. This causes shrinkage, though sometimes unseen unless the castings are to be machined or bored. Usually this is due to using poor brands of pig-iron. Careless skimming is often contributory to defective castings. Special attention to machined castings should be paid by the patternmaker. A casting which may look ideal in the fettling shop is often found totally defective when machined, the metal being full of seams and of a spongy nature. Patternmakers should allow more clearance on the back parts of patterns for machined parts, *e.g.*, gear blanks, hand wheels, bushes, slides, aprons, saddles, etc. Crushes can often be avoided by shaving of the joint where most precautions are necessary. For castings not requiring machining, but to have a good, clean face, use as much new sand in the facing-sand as possible, but not too much moisture. Good sea coal is necessary, and plumbago is preferable to charcoal, as it resists the iron better and tends to give the casting a clean surface. Many pipes are spoilt through faulty cores, the chief fault being insufficient drying. Cores should always be tested before using. Care should be taken to vent well and run on the flanges. Overweighting of the metal is a common cause, and the mould should always be properly fastened before casting. Scabs are often caused through air escaping through the runners. This can be remedied if the runners are kept full of iron whilst pouring the mould.

Enamelled Hollow-ware Trade.

The Committee—consisting of Mr. F. R. Davenport (chairman), Professor A. W. Kirkaldy, and Mr. I. J. Hayward—appointed by the Board of Trade to inquire into and report upon an application made under the Safeguarding of Industries procedure in respect of aluminium hollow-ware, have also been authorised to inquire into and report upon a similar application for the imposition of a duty upon enamelled hollow-ware.

Steel Moulding Sands and their Behaviour under High Temperatures.*

By A. L. Curtis (Chatteris, Cambs.), M.I.Brit.F.

(*Continued from page* 269.)

Artificial Steel Facing Sands or Proprietary Mixtures.

Size diagrams (Figs. 14, 15, 16 and 7a) of samples Nos. 1, 2, 3 and 4, represent the approximate grain-size of four American materials, two of which, viz., Nos. 2 and 3, with the addition of fireclay No. 5, form the basis of an artificial green steel facing sand mixture.

In October, 1922, the author was informed by Mr. R. L. Doty, Vice-President of the Sivyer Steel Castings, Company, Milwaukee, U.S.A.—who kindly provided the samples for test—that his company had used these facing mixtures for several years, which stripped well from steel castings poured at high temperatures from the electric furnace. Such statements are of great interest, because they provide information to work on, as a superficial examination of the samples was, if anything, discouraging.

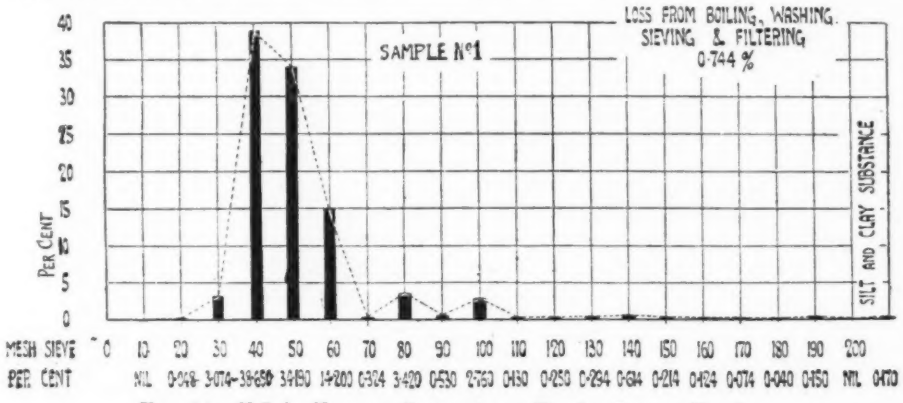


FIG. 14.—U.S.A. NATURAL SILICA SAND (RAW). SAMPLE NO. 1.

Size diagrams (Figs. 14 to 16, and 7a), when compared with each other, give an idea of the difference in grain-size of samples Nos. 1, 2, 3, and 4, and indicate the variation in size of the materials.

It will be noticed from the diagrams of samples 1 and 2, that washing had little effect in reducing the grain-size of the raw material (No. 1 being the raw silica sand and No. 2 the same sand after washing), their respective crops being:—

U.S.A. No. 1 Raw Silica Sand (Fig. 14).	Per cent.	U.S.A. No. 2 Washed Silica Sand (Fig. 15).	Per cent.
On 40 sieve ..	38.650	On 40 sieve ..	39.808
,, 50 ,, ..	34.190	,, 50 ,, ..	33.100
,, 60 ,, ..	14.200	,, 60 ,, ..	12.500

Chemical analysis, however, revealed but small differences in the material after washing, beyond showing a loss in alumina and a gain in silica. When comparing the total fluxes (0.92 per cent. in No. 1, and 0.89 per cent. in No. 2) there seems little to justify the extra expense of washing such a silica sand, as their difference appears insignificant.

A slight difference, however, was noticed in the refractory qualities of the raw and washed sand, when submitted to fusion tests.

It was seen that at approximately 1,710 deg. C. the mixture containing the raw sand No. 1 fused to a cemented mass, whereas the mixture containing the washed sand No. 2 was at the same temperature only reaching the pasty condition. At the higher temperature, approximately 1,790 deg. C., a similar difference will be noticed.

Turning to the actual facing mixture No. 4 shown in size diagram (Fig. 7a), it will be noticed that this material is smaller in grain-size than the silica sand used. The crop of the facing mixture has fallen thus:—

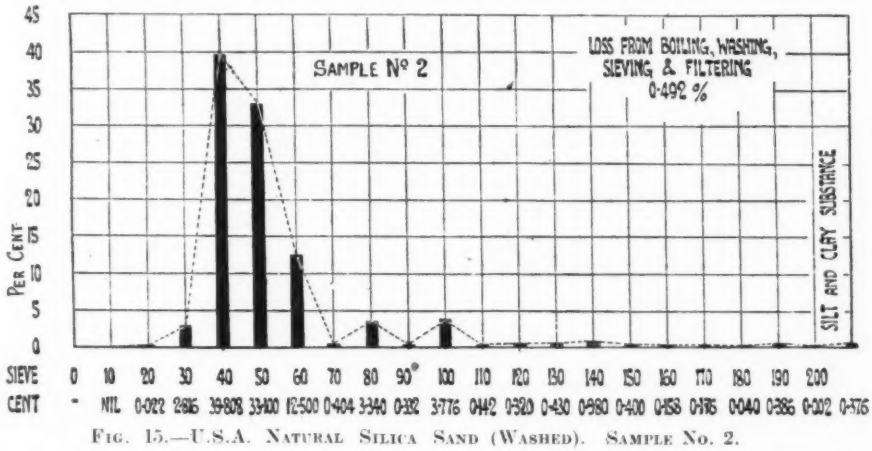


FIG. 15.—U.S.A. NATURAL SILICA SAND (WASHED). SAMPLE NO. 2.

U.S.A. Facing Mixture No. 4 (Fig. 7a).

	Per cent.
On 40 sieve	21.144
,, 50 ,, ...	27.260
,, 60 ,, ...	14.396

Although the crop has fallen in size, fine sand residues between 100 and 200 mesh sieves have increased very slightly in quantity, as will be noticed when comparing the size diagrams of samples Nos. 2 and 4 (Figs. 15 and 7a). This is important, as such sized grains often have an important bearing on permeability.

The facing mixture No. 4 is apparently made up by adding to a not over-used heap sand No. 3 (see size diagram, Fig. 16) a small amount of

* Carnegie Scholarship Memoir (Iron and Steel Institute).

U.S.A. fireclay No. 5 and a small addition of washed silica sand No. 2. A very little addition, however, could have been made to the heap sand No. 3, as an examination of the diagrams will show.

The diagram of washed residues of facing mixture No. 4 (Fig. 7A) seems to indicate that the silt and clay substance is slightly higher than in No. 3 (Fig. 16). In the author's opinion, the clay substance should be of greater strength than the figures indicate, as some of the clay substance shown in heap sand No. 3 (Fig. 16) would have become dehydrated during use.

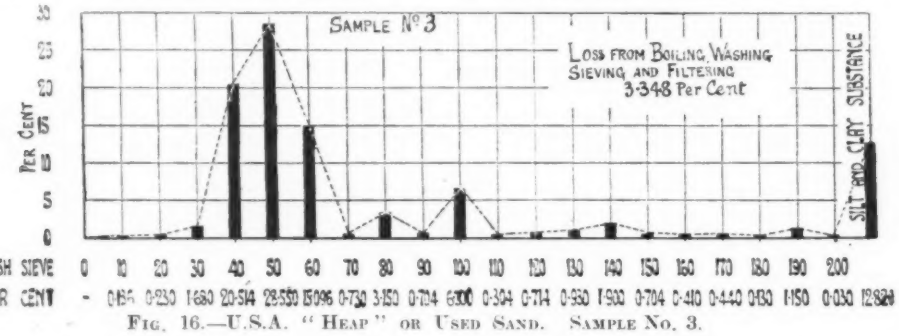


FIG. 16.—U.S.A. "HEAP" OR USED SAND. SAMPLE NO. 3.

The ultimate analyses show that facing mixture No. 4 contains 92.16 per cent. silica, compared with 89.55 per cent. in heap sand No. 3. This difference might be regarded as evidence of freshly added new silica sand.

The great difference in alumina between heap sand No. 3 (Al_2O_3 = 5.09 per cent.) and facing mixture No. 4 (Al_2O_3 = 3.33 per cent.) can probably be accounted for by the fact that the heap sand is a product of an initial and subsequent mixtures, prepared from U.S.A. No. 2 washed silica sand and U.S.A. fireclay No. 5. Repeated use of facing mixtures prepared from such materials would dehydrate the fireclay added and leave silt, which in a short time would increase the alumina content. It cannot, therefore, be assumed that heap sand No. 3 is the main constituent of facing mixture No. 4, if the materials submitted to the author were accurately sampled and represent a stable portion of the heap.

When comparing the total fluxes of the two materials it was found that heap sand No. 3 has a larger sum total than facing mixture No. 4. Probably the heap sand picked up some of its iron during use, and possibly its extra lime and magnesia also, from electric furnace linings.

It will be observed that there is very little difference in loss on ignition between the two samples, which seems to indicate little difference in the strength of the two materials, the clay substance in the heap sand being only partly, and not wholly, dehydrated. Crushing tests made on air-dried samples of both sands confirmed this, results being U.S.A. heap sand No. 3, 23.36 lbs. per cub. in.; U.S.A. facing mixture No. 4, 26.78 lbs. per cub. in.

On considering the analyses of samples Nos. 3 and 4, it cannot be stated that these figures compare unfavourably with those of greensand mixtures in use in England and on the Continent. In fact, a flux content of 2.59 per cent. with silica over 92 per cent. is, in the author's opinion, much above the average analysis of materials used in England, and might be expected to have a high fusion point.

It is now necessary to examine the U.S.A. fireclay No. 5, used for bonding the washed silica sand No. 2, in the first instance, and mixtures prepared from heap sand and silica sand in subsequent practice.

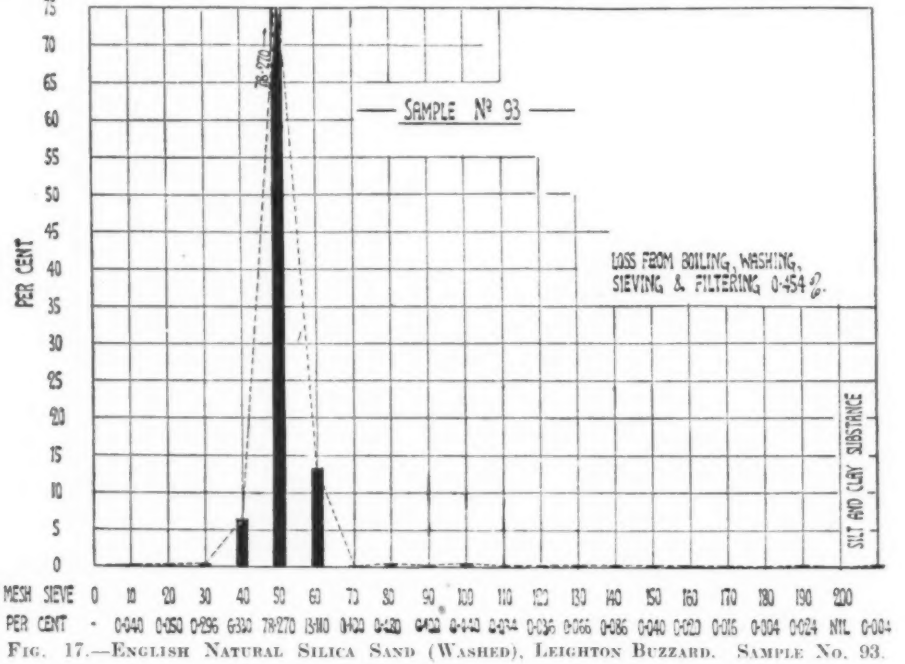


FIG. 17.—ENGLISH NATURAL SILICA SAND (WASHED), LEIGHTON BUZZARD. SAMPLE NO. 93.

This American (U.S.A. fireclay No. 5) fireclay gave the following analysis, which suggests an indifferent bonding material:—Silica, 51.72; alumina, 29.44; iron as peroxide, 4.57; lime, 0.40; magnesia, 0.22; potash, 1.06; soda, 0.91; titanium oxide, 2.15, and loss on ignition, 9.78 per cent. Total fluxes, 9.31 per cent.

The fireclay sample as received was not finely ground, which showed up during mixing. Also when mixed with No. 2 sand and exposed to the blowpipe flame several naked plates or particles of fireclay substance fused in themselves.

It will probably be agreed that a sum total of fluxes such as is shown from the above analysis, viz., 9.31 per cent., is too high for a refractory fireclay, and might have the effect of lowering considerably the fusing point of such a material.

As approximately 20 per cent. of the fireclay would be required to bond a freshly washed silica sand with a grain-size of sample No. 2, it was this analysis which led the author to suspect the practical value of the facing mixture No. 4.

Refractory tests on sample No. 5 indicate that it had a low fusing point. Even at low temperatures, viz., Seger cone 14, approx. 1,410 deg. C., the material was easily attacked and suggested an unsatisfactory fireclay.

This is a very important point, especially when taken in conjunction with Mr. R. L. Doty's statements and the evidence of photomicrographs of the facing mixture No. 4. Mr. Doty stated he had been using this artificial facing mixture, or similar ones, successfully for years, and the castings, which varied in weight and carbon content, stripped well.

It is, however, obvious that fireclay No. 5, employed for bonding both the silica and heap sands, is a poor grade material of low fusing point. An examination of the American artificial facing sand No. 4, particularly those exposed to temperatures of 1,610 deg. and 1,710 deg. C. (Seger cones 27 and 32), showed that the fusion point was not reached at the latter temperature, and therefore "sand-stick" or "burning on" would not be expected to take place. At temperatures between 1,710 and 1,790 deg. C. complete fusion does occur, but this would be outside the range of even very hot teemed steel.

It now follows that American artificial facing mixture No. 4, with 2.59 per cent. fluxes, should be capable of resisting "sand-stick" from molten steel when cast in moulds, on account of its high fusing point. This confirms Mr. Doty's statement, and most important of all, suggests that a fireclay with high total fluxes like No. 5 can be successfully used to bond a silica sand having rounded grains, and heap sand, for use as artificial green steel facing mixtures. The actual fusing point of these samples was not determined, because, in the author's opinion, the general effect of varying increasing heats on a number of samples gives a better idea of the refractory value of a material under test than one sample subjected to its vitrification point.

Having tried to show that an artificial green steel facing mixture with a high fusion point can be made with a washed silica sand, heap sand, and inferior fireclay, which, according to Mr. Doty, produced steel castings free from "sand-stick," other physical properties of the facing mixture No. 4 will be dealt with. Before concluding the above, however, it is desirable closely to investigate the properties of the heap sand No. 3, which formed the basis of facing mixture No. 4.

Some confusion may possibly arise here, if heap sand No. 3 is assumed to be an ordinary used floor-sand, known to English steel founders as such. Judging from the analysis of heap sand, however, this appears to represent a material capable of making steel castings in itself, its total flux content of 3.25 per cent. being no higher than some steel facing sand mixtures in current use in England. It is therefore by no means similar in character to the used or spent sands found on the average foundry floor, which generally have 4.5 to 5.5 per cent. total fluxes.

Test-pieces and their photomicrographs of the American heap sand No. 3 showed it to be scarcely less refractory than the facing mixture No. 4 itself. At cone 32, approx. 1,710 deg. C., the heap sand test-piece was partially fused, whereas the mixture No. 4 was not so badly affected.

It may therefore be inferred that this heap sand No. 3 is really a superior sort of material, properly taken care of, and not to be confused with "worn out" or "spent" sand so well known to all English steel founders.

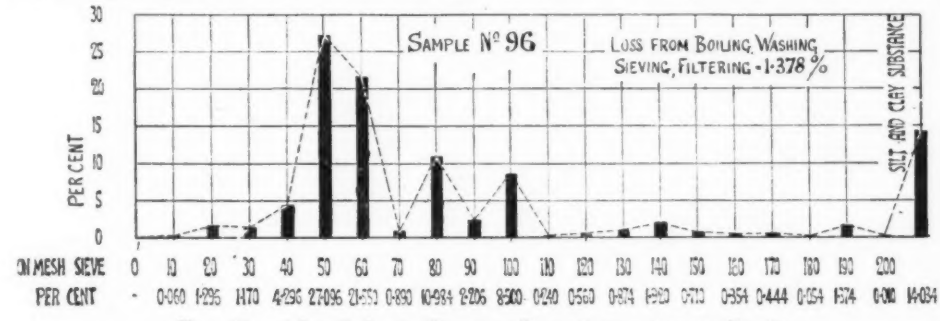


FIG. 18.—"OLD" STEEL FOUNDRY USED SAND. SAMPLE NO. 96.

A certain amount of publicity has been given to the statement that hydrated oxide of iron must be present in a greensand facing mixture in reasonably high quantities to increase bonding effect and enable steel castings to strip freely. Boswell and others mention this point, which in the author's opinion owes its origin to Dr. Percy's reference to a statement by Kampmann,[1] that red English ochre may be used in an artificial sand mixture.

If the American artificial sand mixture No. 4 can be accepted as evidence of a successful mixture, the statement would appear a fallacy, because the total ferric oxide in No. 4 is only approximately 1.14 per cent., and so small an amount could hardly exert such an influence as certain authors suggest. Another instance of an artificial steel moulding sand, capable of producing good results without high iron oxide, is Yorkshire sand, whose Fe_2O_3 is as low as 1.43 per cent. in some of the samples examined by the author. Judging from this, it appears by no means certain that iron oxide is a necessary adjunct to a facing mixture to produce either the necessary bond or promote easy stripping of steel castings.

When making up mixtures by the addition of 20 per cent. fireclay No. 5 to U.S.A. samples Nos. 1 and 2 (raw and washed silica sand), and testing them under the blowpipe, the author was struck with the fact that, if anything, mixtures prepared from new materials were rather less

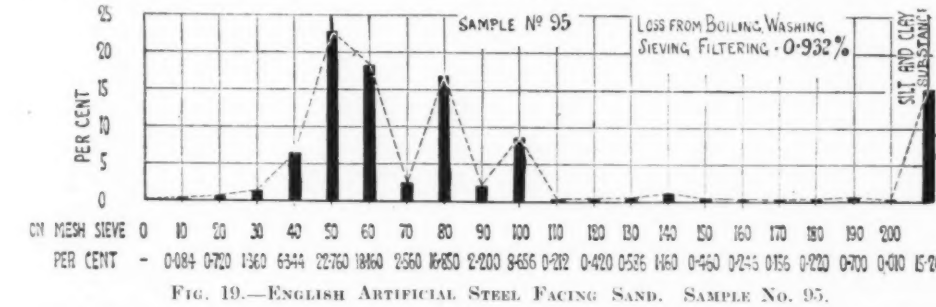


FIG. 19.—ENGLISH ARTIFICIAL STEEL FACING SAND. SAMPLE NO. 95.

[1] "Annales des Mines." 1845 Series, Vol. VIII, p. 689.

refractory than mixtures having a proportion of used sand in their composition. This, and the greater microscopical illuminating power shown by the new materials, as compared with the lighting effect from used materials, suggest that a facing mixture with clean used sand in its composition will resist greater heat than one made up of entirely new materials.

Whether this behaviour is due to carbon picked up by the sand during use it is difficult to say, but the author's experience has been that a greensand facing mixture containing some used dark-grained sand produces better steel castings than a mixture made entirely from new materials.

As an illustration that an English artificial steel facing sand, capable of producing steel castings successfully, can be made in the steel foundry by mixing different strengths of argillaceous sands with old sand and silica sand, details are given of such an artificial mixture, sample No. 95. This mixture was used successfully for making steel castings from the electric furnace in steelworks No. 7, and was composed of approximately:—

25 per cent. strong argillaceous St. Erth sand, sample No. 1323.

25 per cent. weak argillaceous St. Erth sand, sample No. 1322.

35 per cent. silica sand, Leighton Buzzard, sample No. 93 (size diagram, Fig. 17).

15 per cent. "old" steel foundry used sand, sample 96 (size diagram, No. 18).

A sample from the resultant mixture gave the following figures on analysis: Silica, 93.12; alumina, 2.86; iron as peroxide, 1.28; lime, 0.20; magnesia, 0.16; potash, 0.19; soda, 0.03; titanium oxide, 0.70; and loss on ignition, 1.70 per cent; total fluxes, 2.56 per cent.

By comparing this analysis with those of other artificial steel facing sands, viz., sample No. 1970 and sample U.S.A. No. 4, it will be seen that sample 95 is the highest in silica and lowest in alumina and loss on ignition. Its total fluxes, however, are almost equal to U.S.A. No. 4, though higher than sample No. 1970. On the whole there is a close resemblance between the analyses of these three artificial facing sands.

Referring to the grain-size of the three samples (Figs. 19, 2, and 7A), it will be seen that sample 95 is smaller than the other artificial facing sands, No. 1970 and U.S.A. No. 4. Its silt and clay substance is also lower than 1970, but rather higher than the American sand No. 4.

On testing the refractory qualities of the artificial facing mixture No. 95 and its old sand No. 96, it was found that the facing mixture was little less affected at the higher temperatures than the old sand. The high total fluxes, amounting to 5.5 per cent. in the old sand, compared with 2.56 per cent. in the mixture, were probably responsible for the slight difference in fusion points.

It is obvious that an old sand containing 5.5 per cent. of total fluxes could not be used alone for casting steel. On the other hand, it does not appear that a material containing this amount of fluxes will fuse at a much lower temperature than a facing mixture containing only 2.56 per cent. total fluxes when exposed to the naked flame of an oxygen blowpipe.

If, however, samples of two such materials were tested at high temperatures under load (equivalent to ferro-static pressure), it would certainly follow that the old sand containing 5.5 per cent. fluxes would flow and collapse at a much lower temperature than the more pure facing sand. The author is now engaged on work connected with this problem.

It is curious when comparing the size diagrams of samples 95 and 96 (Figs. 19 and 18) to notice that little difference occurs in their respective grain-sizes, the outlines of the diagrams showing a marked similarity. On testing the permeability of the two samples it was found that the facing sand No. 95 was slightly less permeable than the old sand (96), the figures being 93.4 and 95.5 respectively.

It will therefore be seen that artificial facing sands can be made and used in the steel foundry with successful results by using natural argillaceous sands, old sand, and silica sand, if the selection of these materials is carefully made and the mixture properly controlled. As different weights and sections of steel castings require different strengths of facing mixtures, any standard artificial facing sand in use must be altered to suit the work required.

(To be continued.)

Reverberatory Furnace *versus* Cupola.

Some interesting experiments have recently been carried out by the British Reverberatory Furnaces, Limited, of 82, Victoria Street, London, S.W.1, at the North Woolwich works of Messrs. Harland & Woolf, Limited, with the object of ascertaining whether, by the introduction of modern design, the reverberatory could not melt as cheaply as the cupola. How nearly they have succeeded will be shown by the following figures, which have been supplied by Mr. Dunn, the foundry foreman at the North Woolwich works. The furnace used has a capacity of 5 cwt. and has been modified from standard design for the purpose of melting cast iron. The charge consisted of 75 per cent. of best foundry scrap and 25 per cent. of No. 3 Dalzell. The melting losses were in the neighbourhood of 1 per cent., actually 5 lb., a rather surprising figure. The coke consumption is returned at 104 lb., a ratio of 1 to 5.4. According to the metallic losses and the reports of the machine shop, very little Bessmerisation had taken place. The figures cited above do not represent the best obtained. Encouraged by these figures, the British Reverberatory Furnace Company, Limited have designed and are placing upon the market a furnace for melting cast iron. Whilst they do not expect to beat the cupola on coke consumption, they feel that there is a definite place in cast iron metallurgy for a furnace which keeps the iron out of contact with the fuel at a melting cost, but slightly higher than when melting by the cupola. At the moment the designers are limiting their furnaces to relatively small capacities up to a maximum of 2 tons.

The obvious advantages of a reverberatory furnace, other than the separation of the fuel from the metal, with its attendant minimum sulphur pick-up, are (1) the provision of a bath of liquid iron which can be considered as a metallurgical hearth wherein reactions can be instituted at the will of the operator; (2) the furnace being tilting, no tap hole troubles can exist; (3) temperature control, and (4) any iron left over from an early charge can be put back into the furnace to await the closing up of further moulds.

North-East Coast Institution of Engineers and Shipbuilders.

The forty-second annual general meeting of the above was held in Newcastle on October 16, when Sir Eustace H. Tennyson-D'Eyncourt, K.C.B., F.R.S. (Honorary Fellow) was elected President in succession to Mr. Tom Westgarth.

Sir Eustace, who is a well-known naval architect, served his apprenticeship at Sir W. G. Armstrong, Whitworth & Company's Elswick Works. In 1912 he was appointed Director of Naval Construction and Chief Technical Adviser to the Admiralty, which position he held until 1924, when he was appointed Managing Director of Armstrong, Whitworth & Company, though retained as honorary adviser on naval construction to the Admiralty.

At this meeting gold medals were presented to Professor A. L. Mellanby (Royal Technical College, Glasgow), and to Mr. J. Lockwood Taylor, M.Sc., for Papers read during the last session.

SIR WILLIAM HENRY ELLIS, in his presidential address before the Institution of Civil Engineers, on November 3, paid a tribute to the heroism of the men employed in collieries. Serious accidents, he said, from causes entirely beyond the control of the mining engineer, did happen, and there was still considerable loss of life from these causes. The address covered a wide field, and included the consideration of the ideal education for engineers.

Some Notes on Mould and Core Drying.

By N. CALDER.

The subject of the drying of moulds has been recently brought forward by Mr. H. J. Young, F.I.C., in his recent Paper, "A Description of the Perlit Process," and also by the discussion of "Core and Mould Drying," so ably introduced by Mr. W. H. Meadowcroft before the Lancashire Branch. It is the object of the writer to supplement these discussions by outlining recent advances which have been made with the heater or furnace known as Oehm's Heating Element.

This apparatus was fully described in these pages some little time ago. Since that time, however, the entire British and Colonial rights have been acquired by the British Drying and Heating Company, Limited, of 433, Abbey House, Westminster, S.W.1, who have redesigned and modified the furnace in order to obtain a still higher efficiency and greater economy in operation.

Difficulties which have been encountered in the lining of the element have now been satisfactorily overcome, thanks to the assistance of a well-known Sheffield maker of refractory bricks, and the lining now being used is made of highly refractory material which responds excellently to sudden and extreme changes in temperature, and ensures an exceptionally long life.

The heating element, which is very handy and compact in design, comprises two compartments A and B (Fig. 1). The former is purely a firebox, so constructed that primary air can only enter through the firebars and must pass through the fuel bed. This air is aspirated by means of a single small jet of pre-heated compressed air at a pressure of 70 to 80 lbs. per sq. in., which jet issues from a nozzle situated at the top of the compartment B, which also contains a pre-heating coil and a louvred firebrick flue.

The air, upon entering the compartment A, combines with the coke to form carbon-dioxide. The CO_2 thus formed reacts with the incandescent C to form CO. This is then induced by means of the jet through the firebrick louvres, which are highly incandescent. The secondary air re-converts it to carbon-dioxide, which issues from the orifice, situate on the under side of the heater, at a considerable velocity. This gas is led directly into the mould, the velocity being such that a slight static pressure is set up which ensures a rapid circulation, and consequently a uniform temperature throughout the mould. The blacking makes more intimate contact with the mould face, and even drying is obtained. The mould remains porous and in a suitable condition for casting. The temperature inside the mould may be regulated within limits by controlling the supply of compressed air; also by regulating the outlet apertures of the mould.

Caking, cracking, peeling, and other troubles hitherto experienced due to unequal and inefficient drying are reduced to a minimum when this type of heater is used, whilst the speed of drying is extremely rapid.

The writer, who has had a wide and varied experience in drying all sizes of moulds with this portable furnace, finds that very little care on the part of the operator is all that is required to ensure a satisfactory working. It has been found that in practice it is advisable always to place a sheet of iron or other protective material over that part of the mould with which the hot gases come into direct contact.

Stove Drying with Heating Elements.

The principles enumerated above have been most successfully applied to drying stoves, and temperatures as high as 435 deg. C. have been obtained (in connection with the Perlit Process) with a comparatively low fuel consumption. In the ordinary way, however, a temperature of 200 deg. C. is all that is required, and a furnace which would be capable of raising and maintaining this temperature in a stove, say, 25 ft. long by 12 ft. wide by 8 ft. high, would only burn about 56 lbs. of low-grade fuel, such as coke breeze or even cinders, per hour, while the amount of compressed air required would not exceed the equivalent of 25 cub. ft. of free air per min. A run of 12 to 14 hours will be found to be more than adequate to dry right through practically any mould of reasonable size. The moulds may have a thickness of rammed sand up to 18 in. and be contained in a cast-iron box 1 in. thick, so that this drying may be considered rapid.

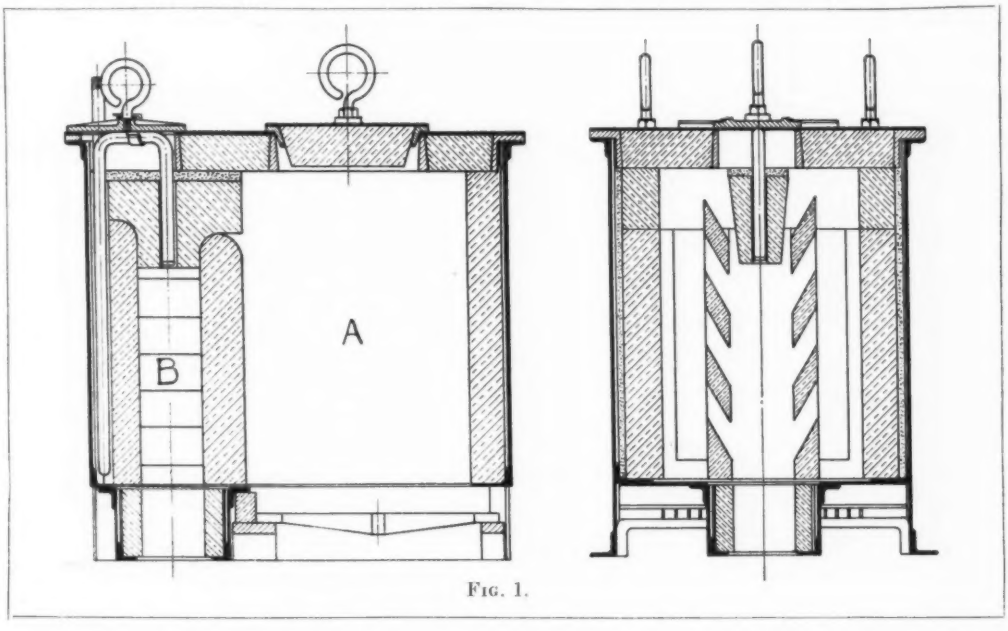


FIG. 1.

This rapidity is due to the fact that the hot gases emanating from the furnace are discharged with a high velocity into the stove, and as is the case with moulds in the floor, a pressure is set up inside the stove causing a rapid circulation and the consequently speedy removal of the steam generated. No chimney is required, a small outlet in the roof of the chamber being all that is necessary, while the temperature inside the stove may be regulated by controlling the compressed air supply; also by increasing or decreasing these outlet apertures.

There are numerous advantages to be attributed to this application over the existing methods, the primary one being the remarkable low fuel consumption, due to the fact that the combustion is carried out at a very high temperature, there being no dilution with excess air, sufficient air only being admitted to transform the products of combustion to CO_2. Nothing but definitely uncombustibles remain, and no smoke is produced.

XUM

An Oehm's heating element as applied to a stove is so designed that the chamber A or firebox is large enough to permit of a charge of fuel sufficient for a run of 8 to 10 hours without attention, while the chamber B is so arranged that it discharges horizontally directly into the bottom of the stove, preferably through the back wall. A very great conservation of heat may be obtained by insulating the stove doors, which should be a close fit.

The writer has used the heater for a variety of purposes, such as ladle drying, and also for maintaining the temperature in cupola receivers, and is at present carrying out experiments with regard to annealing, which he has every reason to believe will prove to be satisfactory.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Wakefield Prison Foundry.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Referring to the interesting article on the foundry in Wakefield Prison, I have since had the pleasure of giving a lantern lecture to some hundred of the inmates, on "Cast Iron under the Microscope," and was particularly impressed by the great interest and attention given to my talk.

The general method of controlling the work of this interesting scheme as reported in the "F.T.J." is fully endorsed. Governor Scott is a remarkable man, and he is doing a *great work*.

The foundry is small, but very well fitted up, and the men are turning out good work. After this visit, I feel that there is a scope for other members of the I.B.F. to help in this good work. Lectures on simple foundry matters would be more than esteemed by the Governor. As you state, the Wakefield experiment is one that deserves the full support of anyone that can render service.

Yours, etc.,
W. E. POOLE.

Keighley Laboratories, Ltd.,
South Street, Keighley.

Perlit Iron.

To the Editor of THE FOUNDRY TRADE JOURNAL.

DEAR SIR,—Mr. Young draws attention to my criticisms in his Paper entitled a "Description of the Perlit Process," published in your issue of October 8, 1925. I accept Mr. Young's ruling that the condition that the iron should be white when cast normally is not a fundamental feature of the Perlit process. Mr. Young states that he has proved that it is possible to produce a grey iron on solidification from a pig-iron which under ordinary circumstances would solidify white. The possibility of doing this by the Perlit method, as I understand it, is a wonderful achievement. I should be extremely interested if Mr. Young would be good enough to give the evidence on which he bases this proof. As I have stated previously, the evidence required is very simple, and I do not think it involves disclosing any information which would hinder the development of the process.

I was disappointed in reading, under the heading of motor car castings, the typically "rule-of-thumb" demonstration of the superior resistance of perlitised iron to impact.

In the discussion on Mr. Young's Paper which appears in your issue of October 15, 1925, Mr. James Smith asked a perfectly definite question regarding a bar cast in Perlit iron, 4 in. thick and 2 ft. long. Mr. Smith asks, "Would the grain of the iron be the same in the centre as on the outside." I have not been able to trace Mr. Young's reply to this in the discussion as printed. This question is a very pertinent one, and I should be interested to learn whether Mr. Young is able to give a perfectly definite answer to this question.—I am, etc.,

J. E. HURST.

3, Sandilands, Troon.

The Effect of Heat Treatment on Grey Cast Iron and Semi-Steel.*

BY O. W. POTTER, Minneapolis, Minn.

In recent years, systematic research has been made to determine the effect of heat treatment and of hot and cold working of metals so that the properties of metal could be more closely controlled. The iron carbon series of alloys is one of the most complicated, yet much research has been done to determine the properties and the effect of heat treatment and impurities on such alloys. The complexities of the composition of cast iron including semi-steel and the difficulty of controlling composition during melting have no doubt become a factor in hindering extensive investigations in this particular field. It is said that the indifference of the grey iron foundrymen to foster research for the study of ways and means to improve the qualities of cast iron has also been a hindering factor to the study of the effects of heat treatment. Data on the effects of heat treatment of cast iron has been reported by Harper, Piowarsky, Knowlton, Forsythe and others and it is the object of this paper to add further data in this important field. If heat treatment of grey cast iron is to become a commercial success, data on research must be so reported and correlated as to make it possible to determine the proper heat treatment necessary for the production and control of the desirable properties. This involves proper chemical analysis, temperature of treatment, rate of heating and cooling, media during treatment, and so forth.

These factors were all considered in the series of investigations which are reported in this paper. The investigation deals with the effects of ten different heat treatments details of which are included. The conclusions derived are:—

(1) Proper heat treatment can greatly improve the general properties of grey cast iron and semi-steel. One of the important results is a uniform hardness and the elimination of massive cementite under annealing.

(2) Properly to heat treat, the correct critical temperature must be located and the temperature carried only enough above this to insure all parts being heated above the critical. This can be determined by ordinary thermal analysis.

(3) The critical temperature of grey cast iron and semi-steel can be calculated with a fair degree of accuracy from the chemical analysis according to the following formula:—

Critical Temperature = 730 deg. Cent. + (28 deg. × per cent. Si) − (25 deg. × per cent. Mn.)

(4) Carbon is oxidised when subjected to a quench from just below critical temperature.

(5) The best combination of properties was obtained by a heat treatment consisting of heating, but to 870 deg. Cent., holding for 3 hrs., cooling to black in furnace and then air cooling. This was the heat treatment recommended by the Schaap process. This produced a uniformly soft product with only a slight reduction in strength properties.

(6) Holding at high temperature for long periods of time or cooling very slowly such temperatures produces extreme softness, but also greatly reduces the strength properties.

(7) To overcome the difficulty of dimensional changes, grey cast iron may be machined, and then subjected to a quench to produce hard iron which is not affected by intermittent heating and cooling below the critical.

(8) The properties of both grey cast iron and semi-steel can be greatly varied by heat treatment and the possibilities of improving and controlling these properties offer great prospects of practicability. To do this additional systematic research is necessary for the coordination of chemical composition, physical properties, and correct heat treatment along with a study of the micro-structures. This along with the use of the ferro alloys in cast iron and semi-steel will help to extend their field of usefulness and prevent somewhat the further encroachment of the other metals and alloys.

* Abstract of a Paper read before the Syracuse meeting of the American Foundrymen's Association.

"Dry-Sand Moulding."*

By C. H. Brown, A.I.Brit.F., Gateshead-on-Tyne.

Dry-sand moulding is similar in many respects to green-sand moulding. The chief points of difference in the two systems are the manipulation, the composition, and general properties of the sand used. When made in dry sand, the mould must be thoroughly dried in a suitable stove, or if the pattern is bedded in the floor, by fires made up in buckets which are suspended in the mould before it can be successfully cast. Dry-sand mixtures contain no combustible substances, such as coal dust, as used for green-sand moulding. They are much stronger and contain more binding matter, but should not be too "close" and compact when in the damp state so as to permit of the escape of the gases generated by the heat from the metal when the mould is filled. These, and other properties, make the dry-sand process more reliable, especially for larger and more important work such as cylinders, valves, liners and other jobs, which are required to stand steam or water pressure, on account of the sand being able to resist the wash of the metal. Owing to the comparatively slow rate of cooling of a dry-sand mould the casting is not hard on the skin as a casting made in a green-sand mould, on account of the dampness of the green-sand mould having a chilling effect on the outer skin and sharp corners.

Milling of Sand.

In the milling of the sand for stove work care should be taken to avoid grinding the sand too much. If ground too much the grains of sand will be so close and compact that the gases will not escape freely from the mould as they should do, during casting.

A mixture of sand for stove work which makes a good open sand, consists of:—1 part of loam; 2 parts of floor sand; and 1 part of burnt sand from the cleaning shop. This is a good sand for important work.

Ramming a Dry-Sand Mould.

Uniform ramming of the mould is essential for the production of good work; wet loam should be used for the core prints owing to it being stronger than the milled sand, and will stand more handling when trying cores in the mould; when ramming the mould up proper care should be taken to ram it soundly, keeping about one inch from the pattern; striking the pattern with the rammer will cause hard spots in the mould which may cause the casting to be scabbed, because a joint was made in the sand with the rammer head, and could be seen when the pattern was drawn out of the mould.

All branches and pockets on the pattern should have ashes inserted, which should be connected to the main channel for the gases coming off the cores and mould. Joints in the mould should be quite sound, and in cutting down to parts where drawbacks are needed, the joints should have a coating of sea sand, or brown paper, so that the drawback will be easily removed and replaced, without trouble.

In the making of top part moulds care should be taken with the special tackle, such as grids if made for pockets; these should have one inch of clearance all round so as to allow contraction to take place when the mould is cast otherwise the casting may split owing to the stresses set up during contraction. Top parts with pockets should be well vented; in flat top parts, however, this is unnecessary. No amount of "finishing" will make up for a badly rammed mould. It is best to water the mould a little before starting to finish so that a good surface can be produced. If the mould is washed over with too much water before blacking, this will cause the face of the mould to crack during drying.

The sand mixture before mentioned does not require the blacking to be sleaked into it, as not much clay matter is present.

* A Paper read before the East Midlands Branch of the Institute of British Foundrymen, Mr. E. Stephenson presiding.

Venting.

There is considerable difference of opinion amongst moulders as to the necessity for venting a dry-sand mould. Some contend that dry-sand moulds require venting, others are of the opinion that this is unnecessary. The author is of opinion that it is very desirable that a mould should be well vented. Suppose there be nine or ten inches of sand in a mould, some may ask, "Why so much sand?" Where one is not dealing with repetition work, it is often necessary to use a box that is very much too big for the job in hand, and a great deal of extra ramming is therefore necessary. A mould of this description cannot be satisfactorily dried in one night. It is agreed that such a mould can be cast without scabbing, if it is dry two or three inches from the surface, but will the casting machine up without having blowholes? Probably it will not, but if the mould had been vented two or three inches from its walls there would have been every chance for moisture and gases to come through the vent holes. All sands, except sea sand, require some artificial means of venting.

Effects of Bad Gating.

In dealing with the gating of a dry-sand mould care should be taken when cutting the runners. It does not matter how much care has been taken in finishing and cleaning the mould before closing, if the runner has been badly formed, trouble will be encountered when the casting is machined, owing to the scum and blacking being trapped in the metal whilst passing through the ingate into the mould. For important castings, such as cylinders weighing about 10 cwts., and cast horizontally, an ingate of about 2 in. × ¼ in. and a 2 in. dia. main runner is advocated. If cast with hot metal, it is certain that a high percentage of cylinders will turn out clean in the core. Liners up to 10 cwts. should be cast on end with, say, two flat runners, 1 in. × ¼ in., to allow the metal to drop from the top of the liner mould, taking care that the metal clears the wall of the mould and core. Using hot metal and a good-shaped basin, good results should be obtained. A small ingate is not advisable on a block casting, as this may cause trouble through the buckling of the top part, as it would be exposed too long to the heat of the metal during casting. This class of mould should be filled more rapidly than moulds with cores. These should have medium-sized runners, so as to allow some of the gases to come off the cores before the metal covers them, which would not be the case with rapid pouring.

Loam Cores.

A mixture for loam cores which has been found successful in practice consists of 1 barrow of yellow loam; 2 barrows of floor sand; 1 sieve of sawdust; and 5 to 6 shovels of ashes, put through a sieve. It is well mixed before milling, and cow hair is added during the grinding. Finally, water is added to suit.

The hair answers two purposes; in the first instance, whilst the raw loam is being moulded into the form desired, the hair assists the tenacity of the parts owing to its being largely charged with water. Again, when the cores are baked in the stove to a very high temperature, the hair is burnt out of the loam, leaving vents. The loam cores are thus perforated in all directions throughout by artificial means. Many foundries use horse manure instead of sawdust and ashes, but the sawdust and ashes are more uniformly mixed with the sand than the manure. Grids should be made with one inch clearance of core box owing to stresses set up after the mould is cast, and should be cast on the light side so that they may be easily broken and removed. The vent wire should not be neglected in parts where brackets have to be contended with, leaving parts of the core practically covered with metal.

DISCUSSION.

MR. S. H. RUSSELL said that he had never been able to convince the man in the shop that no coal dust was necessary in dry-sand moulding, the man's contention being that it made the sand more porous. The coal dust produced additional gas as it burnt. If the coal dust became carbonised, he would agree with the man, but if it did not, the very small gain in porosity was thus negligible. The speaker added that his experience had been against the use of wet loam as an ordinary sand mixture would be rammed up in two-thirds of the time of a wet loam mixture, and the use of the latter damaged the coreboxes. Speaking of flat top parts not requiring venting, he wondered if Mr. Brown had considered the risk of the top coming down by venting it. The loam mixture was an interesting one, and he would be pleased to hear just what function the burnt ashes served in the loam mixture. He would also appreciate more information as to the best way of drying large moulds, and to hear the result of Mr. Brown's experience with portable stoves for this purpose.

In reply THE AUTHOR said that on the North-East coast a sand containing coal dust was not classed as "dry sand," but as a "jobbing sand," which only required to be skin-dried about half an inch through the face of the mould, but it must be well vented. In a dry-sand mould the blacking has the effect of producing a good skin on the casting. Respecting wet loam being more disadvantageous for making cores than a sand mixture, Mr. Brown took as an example a core 2 ft. square, the shell of which would only be made in loam, and the inside filled up with dry sand from the floor before being put into the mould. He could not see where it would take any more time than ramming the core up with sand. The venting of flat top parts was unnecessary, as the risk referred to was run, more especially with shallow top parts. The function of burnt ashes in a loam mixture was to answer the same purpose as horse manure in making the loam porous, but it mixed much more uniformly with the particles of sand, and allowed a better escape of gases. He had not had much experience with portable stoves for the drying of large moulds.

MR. ELDER said that in a top part a vent did not act as a means of escape, but it had a sucking nature, which drew in the top. The majority of moulders did not know the function of coal dust. If the porosity idea was sound, it followed that the more coal dust the weaker the sand.

MR. RUSSELL could not agree with the suction theory; whether in dry sand or green sand, it was always a case of upwards pressure.

THE LECTURER insisted that coal dust was only used to put a skin on castings. If coal dust were used for a very thin job, the casting would be cold-shut, owing to the coal dust impeding the passage of the metal.

MR. BUNTING said that the venting of flat top parts was a mistake, as it allowed the air to get away too quickly. Speaking of the comparative cost of dry-sand moulds and green-sand moulds, Mr. Bunting thought that to dry a job was undoubtedly more costly, but insisted that more risks could be taken than with a green-sand mould. A less skilled man could with safety be put on a dry-sand casting. The crux of success in moulding was to ram up correctly.

In reply, MR. BROWN pointed out that the cost of dry-sand moulding would be higher than the cost of green-sand work, because of the extra handling of the dry-sand mould, and also because of the coke used for the drying, which was not required in green-sand work. He advised for important work which had to withstand steam or water pressure, and also for very heavy work, that it should be moulded in dry sand.

THE BRANCH-PRESIDENT maintained that it was a waste of time to vent top parts. He had never had a casting cave in through not venting, but this had occurred simply through lack of runners. Mr. Brown had told them to keep about 1 in. from the pattern in ramming a dry-sand mould, and he would like to hear how far he advocated keeping away in green sand.

MR. BROWN: In ramming up green-sand work, 1 in. from the pattern with the rammer would be a safe margin.

The Running of Castings.

MR. RUSSELL said that with regard to a suggestion made that the area of the downright should be roughly twice as much as the ingate, that this to him was extraordinary. He thought that the downright should be only slightly larger.

MR. GOODWIN said that in his experience actually the best results were arrived at by allowing a 25 per cent. greater downright area.

In reply, MR. BROWN pointed out he had not suggested that the downright should be twice the area of the ingate; if the downright was 2 in. dia., it should be tapered to 1½ in.

Vote of Thanks.

MR. EVANS, in proposing a vote of thanks to Mr. Brown, agreed with many of the author's remarks, and that they had got nearer to the truth of the question of the flat top. In his opinion, also, top flat parts did not require venting. The whole of his experience tended to the elimination of coal dust in cores. On behalf of the members, he cordially thanked the author for a very logical paper.

MR. MOORE, seconding, said that they had the pleasure of listening to a carefully conceived excellent paper—valuable because of its sound practicability, and which would be of great service to the members of the Institute.

Magnetic Properties of Iron-Nickel Alloys.

By C. H. S. T.

The two elements, iron and nickel, constitute a series of solid solutions right through the series from 0 per cent. iron to 0 per cent. nickel, and within the range of this series alloys of an extremely wide range of physical properties are obtained. In this connection some interesting research has been carried out in the laboratories of the Westinghouse Electric and Manufacturing Company, and it was ascertained that if a combination of high electric resistance and high magnetic permeability is desired, an alloy of 40 to 50 per cent. nickel is very suitable, whereas if a high electrical resistance and a low magnetic permeability is required, a 30 per cent. nickel alloy would be selected. Further, it was ascertained that these alloys are to a large extent amenable to heat treatment, and the conclusion was formed that if the cost of nickel could be reduced, alloys of this type would be used to a far greater extent than at present, especially for magnetic purposes.

It has also been established in these researches that the addition of manganese to an iron-nickel alloy results in a very much lower hysteresis loss, considerably higher permeability for low magnetising forces, and an electrical resistance about five times greater than a straight iron-nickel alloy. Such a combination obviously holds great commercial possibilities, and it has now been developed by the concern mentioned for commercial use.

It is found that while this alloy is greatly affected by metallic addition agents, it seems to be even more affected by oxygen, so much so that to get the best results it is necessary to prepare the alloy and to anneal it in a reducing atmosphere, preferably hydrogen. Annealing in hydrogen at a high temperature is essential if the alloy is required in the form of thin laminations, as it is practically impossible to roll it without subjecting it to oxidation. The alloy is easily made, readily forged and rolled at a bright red heat, and can be cold rolled if necessary. The finished punchings are annealed in an atmosphere of hydrogen or other reducing gas at atmospheric pressure, or slightly above, at a temperature of 1,000 to 1,100 deg. C. for eight to ten hours, and cooled at a convenient rate.

THE GERMAN AUGUST THYSSEN concern in Hamborn has secured the contract for steel pipes for the Capetown Waterworks, South Africa.

MACNAB & Co.

TABOR MOULDING MACHINES (TABOR PATENTS)

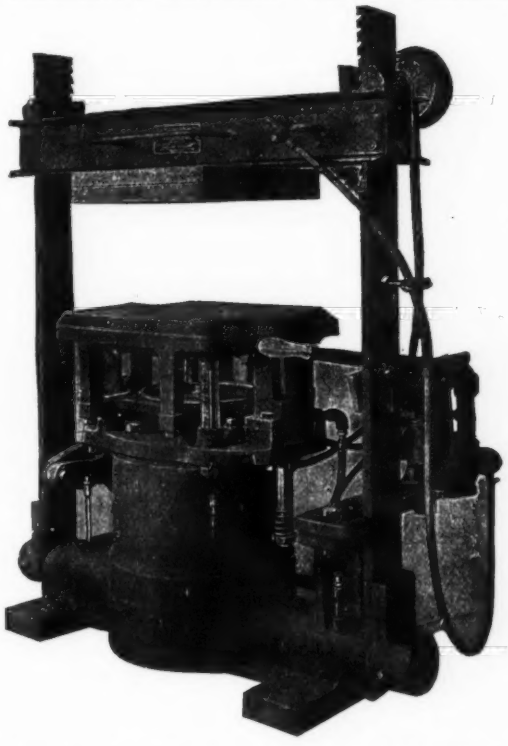
For Every Class of Work.

Pit Type and Portable Combination Shockless Jar Ramming Power Roll-over and Pattern Drawing Machines; Power Squeezing and Jar Squeezing Machines; Shockless Jarring Machines, etc., etc.

SPECIAL FEATURES AND ADVANTAGES:

Accurate Definite Draw with Permanent Accurate Alignment.

All Operations Controlled by One Lever.



Uniformity in size of Castings produced.

All Moulds squeezed alike to whatever Pressure Required.

Minimum Percentage of Wasters.

The above illustrates the TABOR POWER SQUEEZING "SPLIT PATTERN" MOULDING MACHINE, specially suitable for all small patterns which can be split in halves or for flat back Work.

A customer writes—
"The Machines draw perfectly in producing deep castings with the minimum amount of taper, and we are fully satisfied with them, as they are most economical in use and give the maximum production."

Capacities and Dimensions furnished upon application:

56/8, Eagle Street, Southampton Row, London, W.C.1.

Works: TOTTENHAM, LONDON, N.17.

Trade Talk.

DAVID COLVILLE & SONS, LIMITED, have decided to light up four furnaces at Glengarnock which were damped down some months ago.

THE IMPORTS of foreign iron ore at the Senhouse Dock at Maryport during October amounted to 7,200 tons, against 8,600 tons for September, and 3,500 tons at the corresponding period of last year.

W. HAMILTON & COMPANY, LIMITED, Port Glasgow, have booked a contract from C. T. Bowring & Company, Limited, for a single-screw steamer, 350 ft. in length. The vessel will be of the four-deck type.

WILLIAM BAIN & COMPANY, LIMITED, Lochrin Iron Works, Coatbridge, have secured an order for a quantity of structural steelwork for sub-station buildings in connection with the electrification scheme of the Bombay, Baroda and Central India Railway Company.

THE ASCERTAINMENT of the average price of Northamptonshire pig-iron for the quarter ending September 30 has been certified at 63s. 11.807d. per ton. The Northampton ironstone employers, however, have decided to continue the wages percentage of 45 per cent. instead of the 29¾ per cent., which is payable on the wages agreement.

THE BUSINESS of Messrs. Dixon, Stacey & Company (proprietors, Messrs. Crooke & Company), the well-known manufacturers of Silcrete refractory linings, have removed from 122, Victoria Street, to 34-35, Norfolk Street, Strand, London, W.C.2. In addition to manufacturing Silcrete, a new core compound has also been added to their foundry selling lines.

DORMAN, LONG & COMPANY, LIMITED, have decided to restart their Acklam Steelworks, Middlesbrough, three weeks hence. The steel furnaces have been idle for ten months, and the mills for eighteen months, during which period an extensive scheme of remodelling and reconstruction has been carried out. Last week it was announced that the Linthorpe Ironworks were to be restarted.

THE LONDON MIDLAND & SCOTTISH RAILWAY COMPANY has awarded a contract to Beyer, Peacock & Company, Limited, of the Gorton Foundry, Manchester, for three "Garratt" patent articulated locomotives, each weighing 141 tons, for hauling fast goods trains. The total wheel base of each engine will be 79 ft. The bunkers will each carry seven tons of coal, and the tanks 5,000 gallons of water.

THE ENGLISH ELECTRIC COMPANY, LIMITED, announce that instead of treating the Manchester, Bradford, Sheffield and Liverpool districts as four distinct sales areas, each controlled by a separate branch office, they are combining them so as to form a northern area, with headquarters at 196, Deansgate, Manchester, under the direction of Mr. P. H. Symonds, who has been appointed Northern area sales manager for the company. The existing offices at Bradford, Sheffield and Liverpool will be maintained as subsidiary offices.

THE DIRECTORS of the Union Steel (of South Africa), Limited, state that the balance of the plant required to complete the Newcastle blast furnace has now been ordered, and it is anticipated that early in the New Year the steel works at Vereeniging will be able to use pig-iron produced at the Newcastle blast furnace from native ores. The erection of a new Siemens open-hearth furnace in order to bring up the capacity of the Vereeniging works to 50,000 tons of steel per annum is being proceeded with, and a wire rod mill and wire-drawing plant is also being installed and should be in operation within the course of the coming year.

AFTER BEING in existence for many years, the Londonderry Engine Works, Foundry Road, Seaham Harbour, have been closed. The works were formerly the engineering headquarters of the Londonderry Railway, which stretched from Seaham Harbour to Sunderland, and was opened in 1855. The line was the property of the Londonderry family. In 1900 the railway was sold to the North-Eastern Railway Company, and now forms part of the coast branch of the L. and N.E.R. After the sale of the line the engine works were removed by Lord Londonderry to the present site in Foundry Road, where they have been carried on on a smaller scale.

A SUCCESSFUL MEETING of the North-East Coast Local Section of the Institute of Metals was held at Armstrong College, Newcastle-on-Tyne, on November 3. In the unavoidable absence of the Chairman (Mr. H. J. Young, F.I.C.), the meeting was presided over by Mr. Maurice Cook, Ph.D., M.Sc. (Vice-Chairman). An interesting lecture, entitled "Methods and Uses of Metallography," was given by Mr. J. A. Smythe, D.Sc., Ph.D., of Armstrong College. The lecturer gave a practical demonstration of the methods used in studying metals and alloys, and the preparation of a micro-section was illustrated at its various stages. The author also carefully explained the use of the microscope and the photographic camera, and interpreted a few typical micro-photographs.

SEVERAL DERBY FIRMS have contributed gifts of plant and appliances for the equipment of the new workshops and engineering laboratory at Derby, which were opened by Sir Charles Parsons on Friday last. Dr. Bemrose, chairman of the Education Committee, stated that Derby was to be linked up with the new Midlands University.

THE MEMBERS of the Diesel Engine Users' Association have paid a visit to the works of Mirrlees, Bickerton & Day, Limited, Stockport, to inspect the first engine of a new type which they are building. This engine is of the "Mirrlees-Nobel" design, and has four single-acting cylinders, the bore being 22 in., and the piston stroke 29½ in., working on the two-stroke cycle, and developing 1,000 B.H.P. at 125 r.p.m., the piston speed being only 615 feet per minute. The engine inspected was fitted with reversing gear of such a design that it can be incorporated or omitted according to whether the engine is required for marine propulsion purposes or land installation. An interesting feature was the fact that the control was entirely by hand without necessitating the use of Servo-motors.

IN forecasting the trend of trade during the remainder of the year, the quarterly economic supplement of "British Industry," the organ of the F.B.I., says that there are fairly definite signs that the lull in world trade which prevailed throughout the last quarter is coming to an end, and that a new period of expanding trade is about to begin. This movement, which is primarily seasonal in character, received considerable encouragement from the change over to a policy of cheap money and plentiful credit which occurred in August, followed by a subsequent further reduction of the Bank Rate on October 1. If some official assurance could be obtained that the present monetary policy is to be persisted in, this movement might easily reach substantial dimensions, especially if the inflationary tendencies already at work in America remain unchecked. Unfortunately the recent weakness in our exchange, coupled with the heavy outflow of gold, amounting to nearly £7,000,000 during the first three weeks of this month, introduces the possibility of a reversion to a higher Bank Rate during the next few weeks; but such a change would imply miscalculation. Much will also depend on the policy pursued by the New York Federal Reserve Board. The removal of the embargo on foreign investment had taken place, but our labour costs are not yet adjusted to our exchange.

Gazette.

ACCORDING TO A statement issued by the Official Receiver for the Sheffield district, the liabilities of John Crowley & Company, Limited, of Meadow Hall Ironworks, Wincobank, Sheffield, now in compulsory liquidation, amount to £92,668, of which £31,171 is expected to rank. There is an estimated surplus with regard to creditors of £7,061. The secretary of the company, states the Official Receiver, attributes the failure of the company to lack of sufficient capital, to the railway strike of 1919, the moulders' strike of 1920, the mining disputes of 1921 and 1922, and to the great depression in the trade of the country during 1922 and 1923.

Contracts Open.

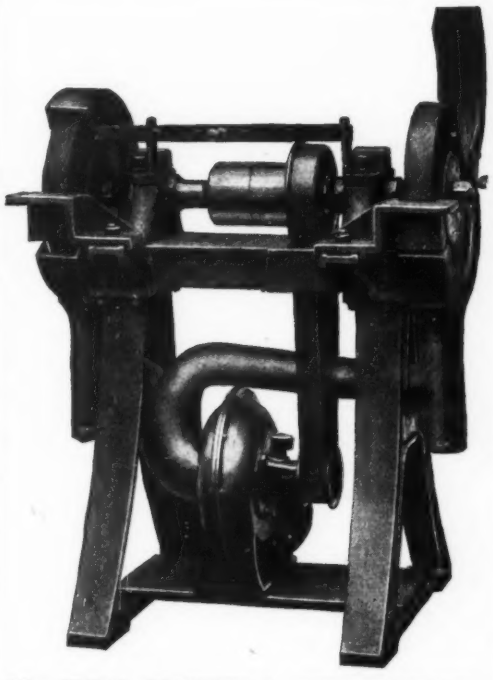
Carlisle, November 19.—Piping for the T.C. Mr. C. W. Salt, city electrical engineer, Electricity Offices, Victoria Viaduct, Carlisle. (Fee £1 1s., returnable.)

London, S.W., November 18.—Steel material, etc., for the Bombay, Baroda and Central India Railway Company, 91, Petty France, Westminster, London, S.W.1. (Fee £1, non-returnable.)

London (Hammersmith), November 19.—Supply and erection of wrought-iron unclimbable fencing, for the L.C.C. The Chief Officer, Parks Department, The County Hall, Westminster Bridge, London, S.E.1.

Pretoria, S.A., January 14.—Piping and tubing for the Union Tender Board, Union Buildings, Pretoria. The Department of Overseas Trade.

Proposed Presentation to M. Léon Guillet.—His recent nomination for membership of the French Academie des Sciences is considered a favourable opportunity by many friends of M. Léon Guillet to present him some token of sympathy, gratitude and admiration for the many services rendered by him to education, science and industry. With this end in view a committee has been formed to collect subscriptions. Contributions to the fund are requested to be sent by crossed cheque to Professor Roszak at 8, Rue Jean-Goujon, Paris. The appeal is signed by leading metallurgists in France, Italy, Belgium, England and the United States.



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Through a 120 Mesh Screen

77% OF THE DUST

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DAVIDSON

Patent

FLUE DUST COLLECTOR

installed in a London Power Station is so *fine* that it will pass through a 120 Mesh Screen

The "Davidson" Patent Flue Dust Collector removes not only cinders from the flue gases, but extracts the most minute particles of dust and grit. The Fan, which provides the Induced Draught, operates the Dust Collector, no other running auxiliary being necessary.

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"DAVIDSON" FLUE DUST COLLECTORS

Have been installed in Shoreditch Power Station; Central Electric Power Station; Charing Cross Power Station; Marylebone Power Station; Treforest Power Station; Deptford Power Station; Grimsby Power Station; Barton Power Station, Manchester; Provan Chemical Works, Glasgow; and many others are in course of erection.

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LONDON, MANCHESTER, BIRMINGHAM, GLASGOW, CARDIFF, BRISTOL AND NEWCASTLE-ON-TYNE.

IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—Business in the Cleveland iron market continues on a steadily increasing scale, both home demand and shipments showing a satisfactory improvement as compared with returns for the preceding quarters of the current year. As evidencing the better outlook in the consuming trades is the fact that buyers are no longer content merely to purchase from hand-to-mouth, but are coming into the market for supplies over extended periods. The business passing is of no great magnitude, but it continues to be steady, and it points to a real change in the situation. With regard to shipments, the quantities from the Port of Middlesbrough and Skinningrove during October show a gratifying improvement. The total for the month was 34,707 tons, as compared with 26,479 tons in September, an increase of 8,228 tons. This is, so far, the highest total of the year with the exception of March. Prices meanwhile remain fairly firm, with No. 3 G.M.B. at 66s. per ton, so that the price, both f.o.b. and on trucks, is now the same. No. 1 stands at 68s., No. 4 foundry 65s., and No. 4 forge 64s. per ton.

The market for hematite at Tees-side is also distinctly more active, reflecting in an increasing degree the improvement in the steel industry. Sheffield is buying forward much more freely, and sales to South Wales, which, in the past, were a regular feature, appear to be picking up very satisfactorily judging by last month's shipments. With regard to prices, there was no change at this week's market, but at 74s. 6d. per ton East Coast mixed numbers were very strongly held, No. 1 being 6d. per ton more. On the North-West Coast prices are also firmer, Bessemer mixed numbers being quoted at £4 1s. 6d. c.i.f. Welsh ports, £4 4s. per ton delivered at Glasgow, £4 7s. per ton delivered at Sheffield, and £4 12s. 6d. per ton delivered at Birmingham.

LANCASHIRE.—Reports from this area also indicate a more active demand for foundry pig, with a fair volume of inquiries on forward account, buyers being evidently apprehensive that the downward trend of prices has been definitely checked. It is claimed that the makers of Northamptonshire foundry iron are now asking 62s. 6d. on trucks at the furnaces, but, of course, this price would preclude any selling of these brands in Manchester. For Derbyshire No. 3 the usual price here now is 73s. per ton, although most of the recent selling has been at 72s. 6d., or roughly at 65s. at the furnaces. For the Lincolnshire brands of foundry iron about 72s. is taken here, equal to about 63s. at the furnaces.

THE MIDLANDS.—In South Staffordshire also there is a more active tendency in regard to foundry pig-iron, chiefly from the ironfounders, who appear to be fairly well occupied at the present time making light castings. The Northants. furnaces are adhering to their figure of 62s. 6d. at the furnaces, and the Derbyshire makers will no longer take any price below 65s.; some of them go to the extent of asking 1s. more than this, and it appears that the present is not the time for getting any concessions from them.

SCOTLAND.—In spite of the improved reports appearing in regard to the other markets, there is really no tangible improvement in the Scotch market for pig-iron. The users of Scotch foundry are only buying trivial lots, and there is still no evidence of any broadening in the demand so far as home consumers are concerned. In view of these conditions, prices are still easy at 78s. f.o.t. furnaces for No. 3 Scotch, and no doubt for a decent parcel this price could be materially bettered.

Finished Iron.

Manufacturers of this class of material report practically no change in the conditions previously reported, the demand for bars remaining insufficient to keep works operating at full capacity. It is quite impossible for the Staffordshire makers to maintain their figure of £12 in view of price-cutting from other districts. It is reported that Lancashire houses have taken as low as £11 10s. for crown iron; £11 12s. 6d. has been quoted frequently; £14 10s. is still the figure for marked bars, and the works making this class of iron are much better situated than the mills dealing with the cheaper qualities. The demand for nut and bolt iron is at a very low ebb, and will continue to be so whilst the Continental works are able to offer this quality at such low prices. At the present moment they are quoting £5 10s. to £5 12s. 6d. per ton, f.o.b. Antwerp, bringing the delivered figure under £6 15s., whereas the Staffordshire price for nut iron is £10 10s.

Steel.

Although at Sheffield conditions are less active than might be expected, the impression is also growing that the worst is over, and that business will shortly show improvement. Basic billets are being bought on a rather larger scale, due, perhaps, as much to the fact that Continental material is rather less readily obtainable as to improved home business. Acid billets are in steady demand, with, on the whole, improving prospects. Steel hoops are rather poor at from £11 10s. to £12. For Sheffield's best steels buying is better, and, generally speaking, there is greater confidence throughout the steel trades. More open-hearth furnaces are being started up, and the big Parkgate works are reported on nearly full time. In the tinplate market there is a better all-round inquiry, and prices also are the turn harder at about 19s. 9d. Most of the cheap second-hand sellers and "bear" merchants have now disappeared, and taken altogether the situation looks healthier than it has done for some time past.

Scrap.

The recent recovery in the pig-iron section has so far had no corresponding effect in the markets for scrap metal, and in Lancashire the demand for foundry material continues extremely quiet. Scrap dealers in Manchester are still trying to keep the price of good broken machinery iron from falling below 72s. 6d. per ton, and, of course, with common pig-iron at 73s., this is only a moderate price; but ironfounders expect to buy machinery scrap at 70s., and are probably able to get all they want at that figure, for there are weak holders about, and probably a larger supply of cast-scrap than can be used up in the present state of the trade. In Scotland machinery cast-iron scrap shows no change, and even at 70s. per ton there are few inquiries and practically no demand. Ordinary cast-iron scrap is in a similar position at 5s. per ton less, while some good quantities of old cast-iron railway chairs have changed hands recently at 70s. to 71s. 3d. They command the same figure as machinery cast-iron scrap, as the quantities available are not so heavy as the former. Light cast iron and firebars are still 55s. to 56s. per ton. The above prices are all per ton, delivered f.o.t. consumers' works.

Metals.

Copper.—The general improvement in trade conditions is again reflected in base metal markets, in which values of standard copper fully maintain the steady advancing tendency noted during the past few weeks. The price of copper being considered very low as compared with other metals, and the American position considered sound, with refinery stocks at well under the normal and domestic consumption continuing on a big scale, the view is held by most dealers on this side that improvement in European industrial conditions should lead to a distinctly firmer market. Current quotations:—*Cash*: Thursday, £62 5s.; Friday, £62 5s.; Monday, £62 2s. 6d.; Tuesday, £62; Wednesday, £61 10s.

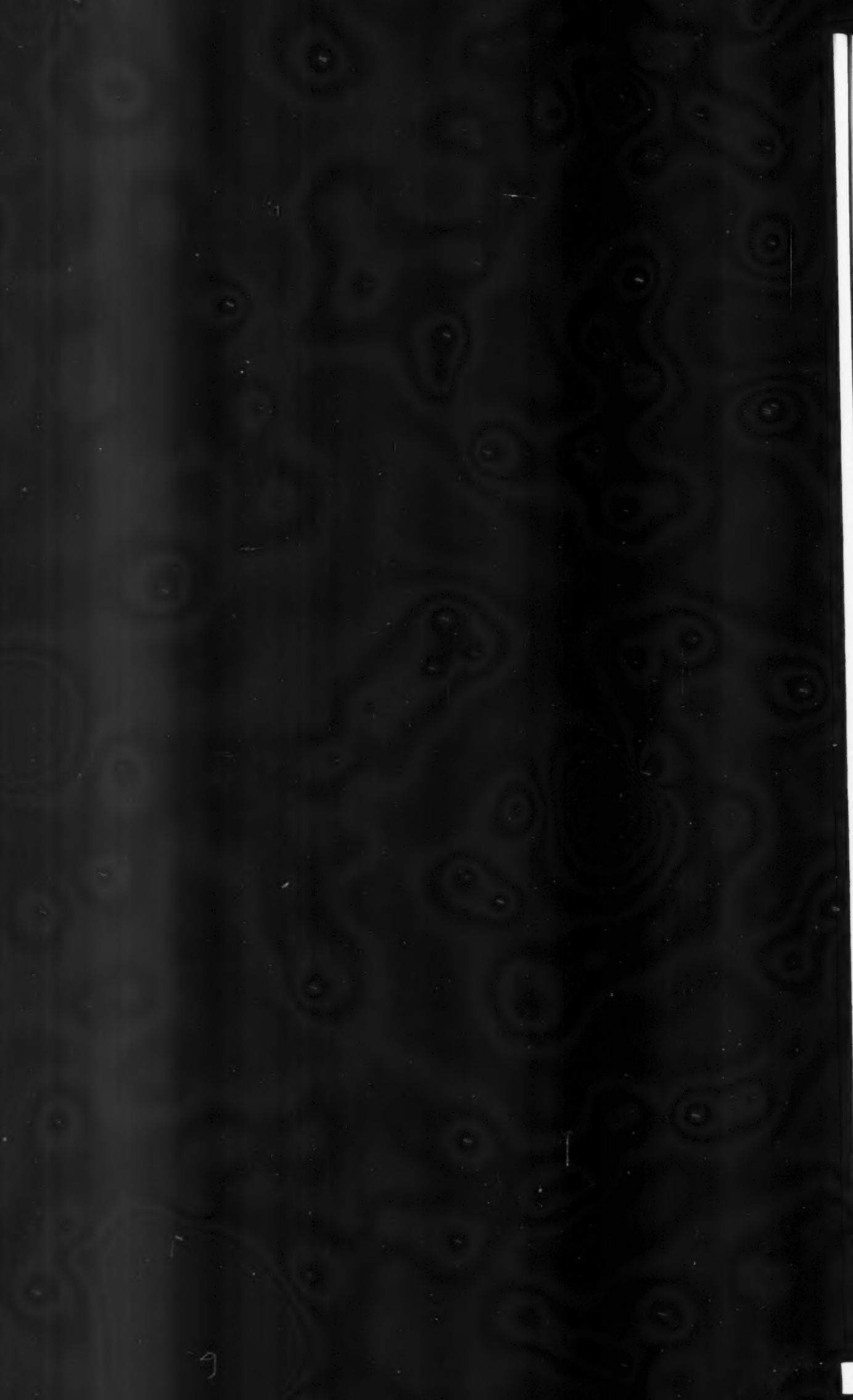
Three Months: Thursday, £63 2s. 6d.; Friday, £63 5s.; Monday, £63 2s. 6d.; Tuesday, £62 17s. 6d.; Wednesday, £62 10s.

Tin.—Among the most striking features of the non-ferrous metal market of late have been the successive sharp advances recorded in tin, which now shows a substantial recovery from the lowest point touched last year. The American demand has been rather hesitating for a time, but under the force of the upward swing considerably larger orders have been eventually placed for Straits tin, which, combined with purchases on Welsh and Continental account has served to add a stimulus to the bull movement under strong influential support. Current quotations:—*Cash*: Thursday, £283; Friday, £283; Monday, £281; Tuesday, £280; Wednesday, £280 12s. 6d.

Three Months: Thursday, £281 15s.; Friday, £281 15s.; Monday, £280; Tuesday, £279; Wednesday, £279 7s. 6d.

Spelter.—A not unexpected lull in the recent buying movement has caused a slight shrinkage in spelter value, but is regarded in well informed market circles as likely to be temporary to this direction. Current quotations:—*Ordinary*: Thursday, £39 16s. 3d.; Friday, £39 8s. 9d.; Monday, £38 15s.; Tuesday, £38 11s. 3d.; Wednesday, £38 17s. 6d.

Lead.—The position of soft foreign pig, although less firm than previously, is intrinsically sound, good purchases having been made on Continental account in contrast to the resales that had been effected for some time previous. Current quotations:—*Soft foreign (prompt)*: Thursday, £37 2s. 6d.; Friday, £37 2s. 6d.; Monday, £37 6s. 3d.; Tuesday, £37 10s.; Wednesday, £37 7s. 6d.



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SELECTED, FRACTURED & SUPPLIED TO ANALYSIS.

DENSE GREY FRACTURE

UNRIVALLED FOR CLEANLINESS & FLUIDITY.

EXCELLENT MACHINING QUALITIES.

SUITABLE FOR
STEAM, HYDRAULIC, GAS & OIL ENGINES.
HIGH CLASS ELECTRICAL CASTINGS.

SPECIAL QUALITY FOR AUTOMOBILE & AERO ENGINES.

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Contractors to THE ADMIRALTY, WAR OFFICE, HOME & COLONIAL GOVERNMENTS & RAILWAYS.

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TELEGRAMS: "RAWSTRON." TELEPHONE: CITY 1405.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	61	10	0
Three months	62	10	0
Electrolytic	68	0	0
Tough	64	10	0
Best selected	65	0	0
Sheets	92	0	0
India	79	0	0
Wire bars	69	5	0
Do. Nov.-Dec.	68	12	6
Do. Jan.	68	17	6
Ingot bars	68	12	6
H.C. wire rods	73	5	0
Off. av. cash, Oct. 62	0	9	$\frac{6}{11}$
Do., 3 mths. Oct. 62	18	9	
Do., Sttlmnt, Oct. 62	0	6	$\frac{6}{11}$
Do., Electro, Oct. 67	14	3	$\frac{6}{11}$
Do., B.S., Oct. 65	1	11	$\frac{1}{2}$
Aver. spot price copper, Oct. 62	0	6	$\frac{3}{4}$
Do., wire bars, Oct. 67	18	2	$\frac{1}{4}$
Solid drawn tubes		13	$\frac{1}{2}$d.
Brazed tubes		13	$\frac{1}{2}$d.
Wire		10	d.

BRASS.

Solid drawn tubes	12d.
Brazed tubes	13½d.
Rods, drawn	11½d.
Rods, extd. or rlld.	7½d.
Sheets to 10 w.g	10½d.
Wire	10½d.
Rolled metal	10½d.
Yellow metal rods	7½d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8½d.

TIN.

	£	s.	d.
Standard cash	280	12	6
Three months	279	7	6
English	280	15	0
Bars	282	0	0
Straits	289	0	0
Australian	285	5	0
Eastern	286	5	0
Banca	289	0	0
Off.aver. cash, Oct. 277	17	3	$\frac{3}{11}$
Do., 3 mths., Oct. 278	0	11	$\frac{13}{22}$
Do., Sttlmt. Oct. 277	16	9	$\frac{9}{11}$
Aver. spot., Oct. 277	16	9	$\frac{3}{4}$

SPELTER.

	£	s.	d.
Ordinary	38	17	6
Remelted	36	16	0
Hard	31	0	0
Electro 99.9	43	0	0
English	39	5	0
India	32	0	0
Zinc dust	45	0	0
Zinc ashes	15	0	0
Off. aver., Oct.	39	5	$4\frac{17}{22}$
Aver., spot, Oct.	39	17	8

LEAD.

	£	s.	d.
Soft foreign ppt.	37	7	6
English	38	15	0
Off. average, Oct.	37	19	$0\frac{1}{2}$
Average spot, Oct.	39	0	4

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	46	0	0
Do. V.M. ex whf.	45	0	0
Rods	52	10	0
Boiler plates	44	0	0
Battery plates	44	10	0

ANTIMONY.

	£	s.	d.
Special brands. Eng.	85	0	0
Chinese	78	0	0
Crude	63	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	14	7	6

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro silicon 45/50%	£11 17 6
75%	£21 5 0
Ferro-vanadium— 35/40%	15/9 lb. va.
Ferro-molybdenum— 70/75% c. free	6/3 lb.
Ferro-titanium— 23/25% carbonless	1/1 lb.
Ferro-phosphorus, 20/25%,	£22 0 0
Ferro-tungsten— 80/85%,c.fr.	1/8 to 1/8½ lb.
Tungsten metal powder— 98/99%	1/11 to 1/11½lb.
Ferro-chrome— 4/6% car.	£23 12 6
6/8% car.	£23 0 0
8/10% car.	£22 15 0
Ferro-chrome— Max. 2% car.	£41 10 0
Max. 1% car.	£50 0 0
Max.0.70%car.	£56 10 0
70%, carbonless	1/5 lb.
Nickel—99%, cubes or pellets	£170 to £175
Cobalt metal—98/99%	10/- lb.
Aluminium 98/99%	£120
Metallic Chromium— 96/98%	3/9 lb.
Ferro-manganese (net)— 76/80%, loose	£15 7 6
76/80%, packed	£16 7 6
76/80%, export	£15 5 0
Metallic manganese— 94/96%, carbonless	2/- lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	s.	d.
Finished bars, 14% tungsten	2	6
Finished bars, 18% tungsten	3	6

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares 3 in. and over	4d.lb.
Rounds and squares under ½ in. to ¼ in.	3d. lb.
Do. under ¼in. to $\frac{3}{16}$ in.	1/-lb.
Flats, ¼in. × ⅛in. to under 1 in. × ⅜ in.	3d. lb.
Do. under ⅛in. × ¼in.	1/-lb
Bevels of approved sizes and sections	6d. lb.
Bars cut to length	10%extra

Scrap from high-speed tool steel—

Scrap pieces	3d.
Turningds andwarf	1d.

Per lb. net, d/s steel makers' work

SCRAP.

	£	s.	d.	£	s.	d.
South Wales— Hvy. steel	3	7	6 to 3	10	0	
Bundled steel & shrngs.	3	2	6 to 3	6	6	
Mixed iron & steel	3	2	6 to 3	5	0	
Heavy cast iron	3	6	0 to 3	8	6	
Good machinery for foundries	3	10	0 to 3	12	6	
Cleveland— Heavy steel	3	0	0			
Steel turnings	1	17	6			
Cast iron borings	1	15	0			
Heavy forge	4	5	0			
Bushelled scrap	3	0	0			
Cast-iron scrap	3	1	0			
Lancashire— Cast-iron scrap	3	10	0			
Heavy wrought	3	5	0			
Steel turnings	2	0	0			

London — Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	54	0	0
Brass (clean)	41	0	0
Lead (less usual draft)	33	10	0
Tea lead	29	10	0
Zinc	28	0	0
New aluminium cuttings	94	0	0
Braziery copper	49	0	0
Gunmetal	48	0	0
Hollow pewter	195	0	0
Shaped black pewter	142	0	0

PIG-IRON.

(*f.o.t. unless otherwise stated*).

N.E. Coast— Foundry No. 1	68/-
Foundry No. 3	66/-
Foundry No. 4	65/-
Forge No. 4	64/-
Hematite No. 1	75/-
Hematite M/Nos.	74/6
N.W. Coast— Hem. M/Nos. d/d Glas.	84/-
,, d/d Birm.	92/6
Midlands — Staffs common*	—
,, No. 4 forge	62/6
,, No. 3 foundry	65/6
Shrops. basic	70/-
,, Cold blast, ord.*	185/-
,, ,, roll iron*	190/-
* d/d Birmingham.	
Northants forge	57/-
,, fdry No. 3	62/6
Derbyshire forge	60/-
,, fdry. No. 3	65/-
,, basic	65/-
Scotland— Foundry No. 1	83/6
,, No. 3	78/6
Hem. M/Nos.	78/6
Sheffield (d/d district)— Derby forge	64/-
,, fdry. No. 3	68/-
Lincs. forge	66/6
,, fdry. No. 3	69/-
E.C. hematite	85/-
W.C. hematite	87/-
Lincs. (at furnaces)— Forge No. 4	60/6
Foundry No. 3	63/-
Basic	65/6
Lancashire (d/d eq. Man.)— Derby forge	67/6
,, fdry. No. 3	73/-
Northants foundry No. 3	75/3
Dalzell, No. 3	110/-
Summerlee, No. 3	96/-
Glengarnock, No. 3	96/-
Gartsherrie, No. 3	96/-
Monkland No. 3	96/-
Coltness, No. 3	96/-
Shotts, No. 3	96/-

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars(cr.)	11	5	0 to 12	10	0	
Angles			11	10	0	
Tees to 3 united ins.			12	0	0	
Nut and bolt			11	0	0	
Hoops	14	0	0 to 15	0	0	
Marked bars (Staffs.) f.o.t.			14	10	0	
Gas strip	12	10	0 to 12	15	0	
Bolts and nuts ¾ in. × 4 in.			16	15	6	
Steel— Ship plates	7	5	0 to 8	7	6	
Boiler plts.			11	10	0	
Chequer plts.	£9	15	0 to 10	5	0	
Angles	£7	0	0 to 7	15	0	
Tees	£8	5	0 to 8	15	0	
Channels	£ 6	17	6 to 7	7	6	
Joists	£7	0	0 to 7	15	0	
Rounds and Squares 3 in. to 5½ ins.			8	15	0	
Rounds under 3 in. to ⅜ in.			8	10	0	
Flats, over 5 in. wide and up			9	5	0	
Flats, 5in. to 1½in.			8	5	0	
Rails, heavy			8	0	0	
Fishplates			12	10	0	
Hoops (Staffs.)			10	10	0	
Black sheets, 24g.			11	5	0	
Galv. cor. sheets, 24g.			16	12	6	
Galv. fencing wire 8g. plain			14	0	0	
Billets,soft	£6	0	0 to 7	10	0	
Billets, hard			8	12	6	
Sheet bars			6	5	0	
Tin bars d/d			6	5	0	

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	3
Sheet to w.g.	1	3½
Wire	1	4
Rods	1	3
Tubes	1	8½
Castings	1	2

Delivery 3 cwt. free
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

Per lb.

Ingots for raising 9d. to 1/3

Rolled—

To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3¼ to 1/9¼
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½

Wire round—

3/0 to 10 G. 1/6½ to 2/1½
with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	23.26
No. 2 foundry, Valley	21.26
No. 2 foundry, Birm.	20.00
Basic	20.76
Bessemer	21.76
Malleable	21.26
Grey forge	20.76
Ferro-mang. 80% d/d	115.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	33.50
O.-h. billets	33.50
O.-h. sheet bars	33.50
Wire rods	45.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	2.00
Tank plates	1.80
Beams, etc.	1.90
Skelp, grooved steel	1.90
Skelp, sheared steel	1.90
Steel hoops	2.50
Sheets, black, No. 28	3.15
Sheets, galv., No. 28	4.30
Sheets, blue an'l'd, 9 & 10	2.30
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv.	3.35
Tinplate, 100 lb. box	£5.50

COKE (at ovens).

Welsh foundry	32/6 to 37/6
,, furnace	20/- to 25/-
Durham & North. foundry	30/- to 33/-
,, furnace	15/- to 15/6
Other Districts, foundry	30/- to 33/-
,, ,, furnace (basis)	11/9

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20×14, box		20/-
,,	28×20, ,,		40/-
,,	20×10, ,,		29/6
,,	18¾×14, ,,		20/10½
C.W.	20×14, ,,		18/1½
,,	28×20, ,,		36/3
,,	20×10,		25/4½
,,	18¾×14, ,,		18/9

Terneplates 28 × 20, 36/3 per box basis f.o.b.

SWEDISH IRON.

Bars, hammered	£19/0 to £20/0
Rolled Ord.	£16/0/0 to£16/10/0
Nail rods	£16 5 0 to £16 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£10 to £14

Pig-iron £6 15 0 to £7 0 0 all f.o.b. Gothenburg.

TUBES.

Up to and incl. 6 in.

Gas .. 55% } Tube prices
Water .. 50% } are
Steam .. 45% } now free.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.	
Nov. 5	62	5	0	No change
,, 6	62	5	0	,, ,,
,, 9	62	2	6	dec. 2/6
,, 10	62	0	0	,, 2/6
,, 11	61	10	0	,, 10 –

Electrolytic Copper.

	£	s.	d.	
Nov. 5	69	0	0	No change
,, 6	69	0	0	,, ,,
,, 9	68	15	0	dec. 5/-
,, 10	68	15	0	No change
,, 11	68	0	0	dec. 15/-

Standard Tin (Cash).

	£	s.	d.	
Nov. 5	283	0	0	inc. 60/-
,, 6	283	0	0	No change
,, 9	281	0	0	dec. 40/-
,, 10	280	0	0	,, 20/-
,, 11	280	12	6	inc. 12/6

Tin (English ingots).

	£	s.	d.	
Nov. 5	283	0	0	inc. 60/-
,, 6	283	5	0	,, 5/-
,, 9	281	0	0	dec. 45/-
,, 10	280	0	0	,, 20/-
,, 11	280	15	0	inc. 15/-

Zinc Sheets (English).

	£	s.	d.	
Nov. 5	46	0	0	No change
,, 6	46	0	0	,, ,,
,, 9	46	0	0	,, ,,
,, 10	46	0	0	,, ,,
,, 11	46	0	0	,, ,,

Spelter (ordinary).

	£	s.	d.	
Nov. 5	39	16	3	No change
,, 6	39	8	9	dec. 7 6
,, 9	38	15	0	,, 13 9
,, 10	38	11	3	,, 3 9
,, 11	38	17	6	inc. 6 3

Lead (English).

	£	s.	d.	
Nov. 5	38	15	0	No change
,, 6	38	15	0	,, ,,
,, 9	38	15	0	,, ,,
,, 10	38	15	0	,, ,,
,, 11	38	15	0	,, ,,

Sweden.—Production of Steel Ingots.

Year.	Bessemer. Acid.	Bessemer. Basic.	Open-hearth. Acid.	Open-hearth. Basic.	Crucible and electric.	Total.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.
1904..	78,577		252,832		1,162	332,571
1905..	78,204		288,675		1,319	368,198
1906..	84,633		311,485		1,457	397,525
1907..	77,036		341,893		1,287	420,216
1908..	38,331	42,723	149,947	205,450	1,169	437,617
1909..	29,026	34,325	100,987	147,770	917	313,035
1910..	44,150	53,433	146,510	225,941	2,215	472,249
1911..	41,116	52,737	148,323	224,383	4,309	470,868
1912..	43,317	63,937	160,418	243,700	3,940	515,312
1913..	45,069	70,770	187,460	281,920	5,660	590,879
1914..	32,050	61,150	170,580	238,950	4,590	507,320
1915..	25,920	65,150	230,660	273,100	5,580	600,410
1916..	26,900	49,100	244,750	283,940	9,390	614,080
1917..	21,400	56,540	215,390	275,860	11,890	581,090
1918..	11,760	54,390	192,000	273,000	14,330	545,480
1919..	16,830	40,760	149,730	270,800	13,120	491,240
1920..	17,260	36,080	148,870	221,360	13,900	437,470
1921..	33,100		164,100		14,400	211,600
1922..	36,700		257,100		17,100	310,900
1923..	35,100		217,800		17,700	270,600
1924..	63,700		398,400		33,400	495,500

Sweden.—Production of Puddled Blooms and Steel Ingots.

Year.	Puddled-iron blooms.	Steel ingots.	Total.
	Metric tons.	Metric tons.	Metric tons.
1894 ..	204,517	167,835	372,352
1895 ..	188,726	197,177	385,903
1896 ..	188,396	257,025	445,421
1897 ..	189,632	274,206	463,838
1898 ..	198,923	263,973	462,896
1899 ..	195,331	272,480	467,811
1900 ..	188,455	299,604	488,059
1901 ..	164,850	269,196	434,046
1902 ..	186,076	286,416	472,492
1903 ..	192,342	318,212	510,554
1904 ..	189,246	332,571	521,817
1905 ..	182,340	368,198	550,538
1906 ..	178,298	397,525	575,823
1907 ..	174,405	420,216	594,621
1908 ..	152,256	437,617	589,873
1909 ..	120,669	313,035	433,704
1910 ..	151,713	472,249	623,962
1911 ..	146,700	470,868	617,568
1912 ..	148,100	515,312	644,181
1913 ..	153,400	590,879	736,200
1914 ..	113,300	507,320	620,620
1915 ..	119,200	600,410	719,610
1916 ..	119,000	614,080	733,080
1917 ..	114,400	581,090	637,480
1918 ..	92,000	545,480	616,800
1919 ..	62,300	491,240	553,540
1920 ..	60,500	437,470	497,970
1921 ..	24,400	211,600	236,000
1922 ..	39,800	310,900	350,700
1923 ..	38,970	311,000	349,970
1924 ..	46,100	495,500	541,600

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P.O. BOX 1580, CAIRO.

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SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.,

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XUM

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 7 words per line. Minimum charge for one insertion 3/-.

SITUATIONS VACANT AND WANTED.

MOULDER or COREMAKER, steady and reliable, seeks situation; wide experience in cupola practice; services with Allen & Company, Bedford; Petters & Son, Yeovil; Fielding & Platt, Gloucester; constant position appreciated and good production given.—M., 121, Elthorne Avenue, Hanwell, W.7.

ELECTRIC STEEL-MELTER wanted to supervise erection and working of 1-2 ton furnaces; state production data already experienced (units per ton, etc.); no experimental results wanted; good appointment offered to suitable applicant.—Box 522, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

MANAGER, for large Foundry in Eastern Counties, producing Steel, Malleable and Grey Iron Castings; must have sound theoretical knowledge, combined with practical experience, and have proved his capacity for management; a good salary is offered to a first-class man. Applicants should state age and give full particulars of training and career.—Box G. W. S., Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

WANTED, a thorough practical and experienced Foreman for the Steel Dressing and Despatch Department in a large Steel Foundry in the North of England; must be a good organiser.—Apply, Box 516, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

SPUN Iron Pipe Operator seeks post on similar work; 3½ years' experience of rotary pipe casting; late Stanton Ironworks Company.—A. WIDDOWSON, Stanton-by-Dale, near Notts.

FOREMAN wanted, in London district, for small Iron and Non-ferrous Foundry, doing light and medium work; must have proved ability in handling cupola, mixing metals, machine and hand moulding, and able to obtain quick output of sound clean castings.—State age, full experience, wages and when free, to Box "A. J. S.," Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

REPRESENTATIVES required in all districts for sale of four well-known materials used in the Foundries; splendid opportunity to persons who can influence new business; sole agency offered with high rate of commission.—Write, Box 526, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

BUSINESSES FOR SALE AND WANTED.

TO LET.—Fully-equipped Iron and Brass Foundry; capacity 10-12 tons per week.—Write, 30, Broadway, Bexley Heath, Kent.

OLD-ESTABLISHED Malleable and Grey Iron Foundry in Sheffield district for disposal, or would consider experienced gentleman with some capital to take over complete management.—Write in the first instance to Box 524, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

TENDERS.

ADMINISTRATIVE COUNTY OF LONDON.

THE London County Council invites Tenders for the supply and erection of wrought-iron fencing to enclose a new Park at Eltham. Plans, Specifications and Forms of Tender can be obtained on application to the Chief Officer, Parks Department, The County Hall, Westminster Bridge, S.E.1. Tenders must be forwarded in the envelope provided addressed to the Clerk of the Council at The County Hall, and received not later than 4 p.m. on Thursday, 19th November, 1925. No Tender received after that time will be considered.

The Contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and Form of Contract and in the London County Council Gazette.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX,
Clerk of the London County Council.

PATENTS.

PATENT YOUR INVENTIONS. Trade-mark your Goods. Advice, Handbook and Cons. free.—B. T. KING, C.I.M.E. (Regd. Pat. Agent, G.B., U.S.A., and Can.), 146A, Queen Victoria Street, E.C.4. 38 years' refs. 'Phone 682 Central.

MACHINERY.

FOR SALE.—20-in. and 24-in. Hall's Invincible Sand Mixers; the original and best machine in the market for mixing old and new Foundry Sand, Coal Dust, etc.—Apply, PENNEY & PORTER (ENG.), LTD., Lincoln.

SAND MIXERS.—New and second-hand. Ask us to quote.—W. BREALEY & COMPANY, LTD., Russell Street, Sheffield.

MACHINERY, PLANT, &c.

Nearly New No. 2 Robey Smith Patent AUTOMATIC BEVEL GEAR PLANER, by Smith & Coventry.

No. 1 Farwell AUTOMATIC GEAR HOBBING MACHINE, capacity diam. 12 in., width of face cut 6 in.

No. 38 BROACHING MACHINE, by J. N. Lapointe, capacity side of broach 3½ in., stroke 56 in.

10-in. stroke SLOTTING MACHINE, by G. F. Smith, table 24 in. diam., minimum depth of gap 15 in.

NEARLY NEW STEEL LANCASHIRE BOILER, 30 ft. x 9 ft., reinsurable at 100 lbs. working steam pressure, complete with steam and furnace fittings, etc.

TWO VERTICAL COCHRAN LAND TYPE BOILERS, 14 ft. high x 7 ft. diam., new in 1917; heating surface about 500 sq. ft. per boiler, 100 lbs. working pressure.

Catalogue (6,000 lots) on application.

THOS W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

MISCELLANEOUS.

PATTERNS.—Inquiries solicited; quotations by return; shop equipped with modern machinery; quick delivery.—CLEGHORN & COMPANY, Midland Pattern Works, Spring Gardens, Worcester. Phone 264.

WHEN IN DOUBT send your orders or inquiries for Materials and Requisites for Iron and Brass Foundries to WILLIAM OLSEN, LIMITED, COGAN STREET, HULL. Largest stock; prompt deliveries; carriage paid terms.

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Ganister or Silica Bricks and Blocks (any shape or size).
Sands, Cements, Ganister.—*Let us have your enquiries.*
THE CLEVELAND MAGNESITE & REFRACTORY CO., LTD.,
Normanby Brickworks, Normanby, Eston, Yorks.

CUPOLAS

4'-6" THWAITES, new condition, with spark arrester and receiver	£95
4'-0" THWAITES, nearly new, without spark arrester or receiver	£80
2'-6" THWAITES, including S.A. and receiver	£45

LADLES

12 Ton EVANS, as new	£90
6 Ton Wormgeared, good condition	£45
3 Ton THWAITES, NEW, UNUSED	£35
2½ Ton EVANS, good as new	£28
1½ Ton EVANS, NEW, UNUSED	£24

BUY FROM ME AND SAVE MONEY.
ALEX. HAMMOND,
FOUNDRY MACHINERY MERCHANT,
"BOXTED," SLOUGH.